SATELLITE TV ASIA '93

KATA BEACH RESORT
Phuket, Thailand
27-29 October, 1993

Organized by *MLE INC*
Publisher of the
1992/93 World Satellite Almanac,
1993/94 World Satellite Annual, and
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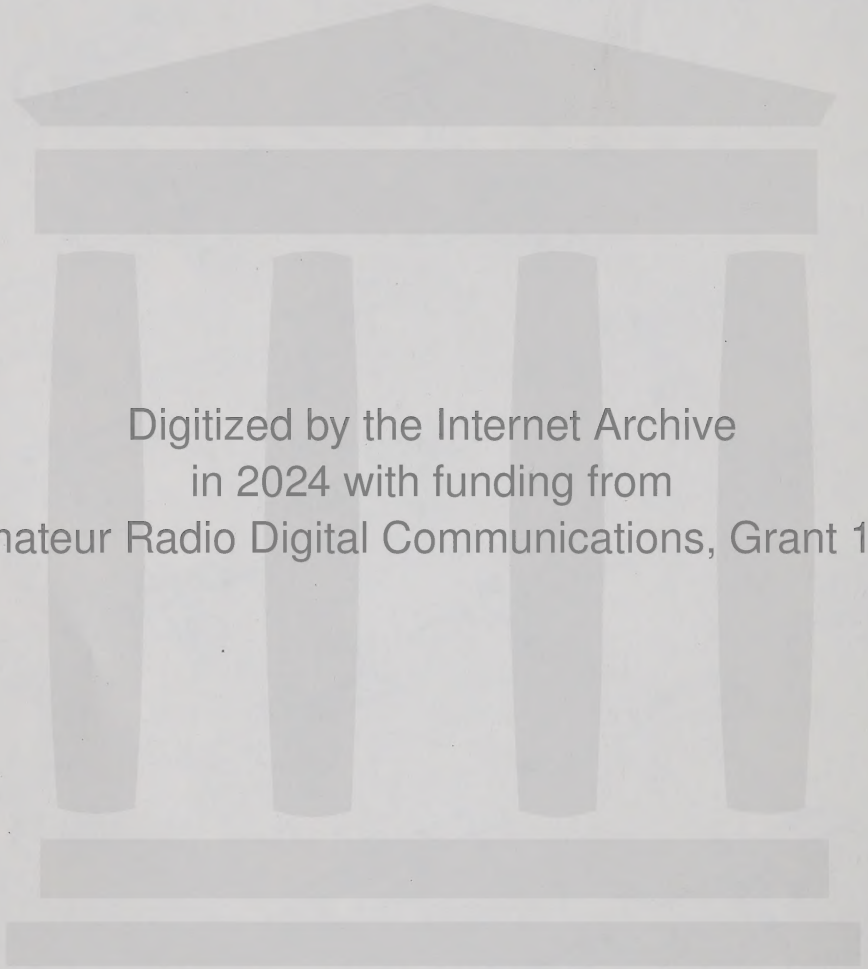

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SATCOM ASIA '94

CHIANG MAI, THAILAND

OCTOBER 22 - 24, 1994

THE EMPRESS CHIANGMAI

AT THE EMPRESS HOTEL
& CONVENTION CENTRE

Organized by

Mark Long Enterprises Inc.

Publisher of

The World Satellite Almanac

The Asia/Pacific Satellite Business Directory

THAILAND TO SERVE AS HOST COUNTRY FOR SATCOM ASIA '94

MLE INC has selected the Southeast Asian nation of Thailand to serve as the host country for the **Satcom Asia '94** Conference. The Kingdom of Thailand is centrally located within the region—almost equidistant between India and China. The Thai people's worldwide reputation for providing exceptional hospitality to overseas visitors was another major reason for its selection as host nation.

"A major characteristic that the Thais have inherited from Buddhist culture is an openness of mind," says Dr. Rapee Sagarik, author of Culture and Environment in Thailand. "Witness the natural, almost innocent pleasure they take in welcoming strangers from other communities and cultures with friendship and kindness."

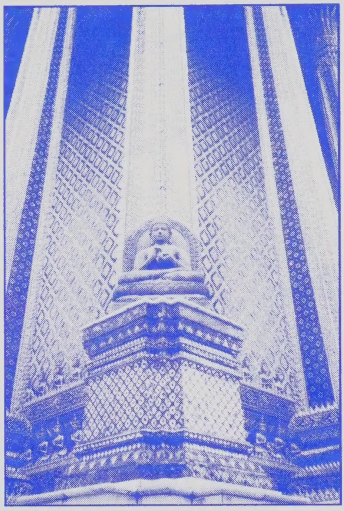


PHOTO BY MARK LONG

Home satellite TV became legal in Thailand in 1992. During the past two and one-half years, more than 130,000 home and community satellite TV systems have been installed throughout the country. In December of 1993, Thailand's first domestic satellite—Thaicom A1—was launched into space. Thaicom operator Shinawatra Satellite Public Co., Ltd., expects to inaugurate direct-to-home Ku-band satellite TV services in the Fall of this year. Moreover, several major manufacturers and distributors of satellite TV equipment are located in the city of Bangkok.

Geography and Climate. Thailand is some 510,000 square kilometers in area—about the same size as France—with a population of about 65 million. Thailand enjoys a tropical climate with three distinct seasons: a hot season from March through May; a rainy season from June to September; and a cool season from October through February. Average annual temperature is 28° C (83° F).

Language and Currency. While spoken and written Thai remain largely incomprehensible to the first-time visitor, English is widely understood, particularly in the areas that are popular with overseas visitors. English and other European languages are spoken in most hotels, shops, and restaurants, and Thai/English road and street signs are found nationwide. The Thai currency is the Baht. One US Dollar is worth approximately 25 Baht.

The Conference Site of Chiang Mai. This year's conference will be held in the city of Chiang Mai, which is Thailand's second largest city next to Bangkok. Chiang Mai—located in the cool, mountainous North of Thailand, is the Kingdom's second most popular tourist destination, again next to Bangkok.

PHOTO BY MARK LONG

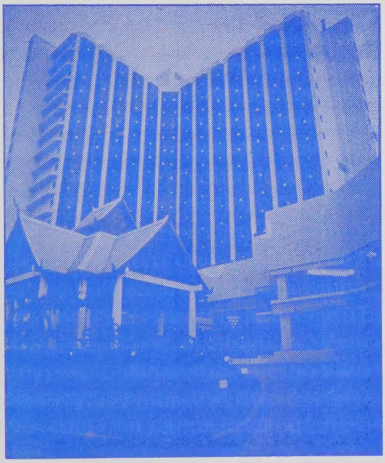
Founded in the year 1296, the ancient city of Chiang Mai is rich in culture and mystique. Many historic temples, called "wats," date back to the 1300s, and await your discovery. Their flamboyant mixture of Burmese, Sri Lankan and Lanna architectural styles is complemented by the use of ornate woodcarvings, leonine and angelic guardian statues and pagodas laced

PHOTO BY MARK LONG

with gold filigree.

Until the late 1920s, Chiang Mai was isolated from Bangkok and could only be reached either by an arduous river journey or by riding on elephant back. Such isolation helped to create the distinct characteristics of its renowned artisans and craftsmen, who have handed down through the generations their special techniques in making beautiful silverware, handwoven silks, and woodcarvings. The lush, cool mountains surrounding Chiang Mai also are home to several hill tribes whose beliefs and lifestyles are more in tune with times long past than with today's modern world.

The Empress Hotel and Convention Center. For this year's conference, MLE INC has selected the *Empress Hotel and Convention Center* in Chiang Mai, which offers 375 rooms and suites graciously decorated in the "Lanna Thai" style of Northern Thailand, with ornate woodcarvings and handwoven silks that create a truly regal atmosphere. The 17-story hotel's many facilities include several international restaurants, a swimming pool, a fitness center, a business center, break-away meeting rooms, and the popular Crystal Cave discotheque.



Getting to Chiang Mai. Most attendees will reach Chiang Mai via Thailand's major gateway at Bangkok's Don Muang International Airport, which is connected by numerous daily flights from Europe, North America, Asia and Australia. From Bangkok, attendees can choose among the many daily Thai Airways connecting flights from Bangkok to Chiang Mai, where they can complete all Thai customs formalities. Taxis and other means of ground transportation are available upon arrival in Chiang Mai.

SATCOM ASIA '94

EMPRESS HOTEL & CONVENTION CENTRE
CHIANG MAI, THAILAND
OCTOBER 22 - 24, 1994

THE EMPRESS CHIANGMAI

ORGANIZED BY MARK LONG ENTERPRISES, INC.

OCTOBER 22, 1994 - BASIC WORKSHOP, SESSION 1
(MORNING). *VIDEO, VOICE & DATA: SATELLITE TRANSMISSION AND RECEPTION TECHNIQUES. COVERING TVRO AND VSAT COMMUNICATIONS NETWORKS.*
(INCLUDES BREAK-AWAY SESSIONS CONSISTING OF SMALL GROUPS FOR HANDS-ON TRAINING).

OCTOBER 22, 1994 - BASIC WORKSHOP, SESSION 2
(AFTERNOON). *SMATV SYSTEM PLANNING, INSTALLATION, AND OPERATION.*
(INCLUDES BREAK-AWAY SESSIONS CONSISTING OF SMALL GROUPS FOR HANDS-ON TRAINING).

OCTOBER 23, 1994 - PLENARY SESSION 1
EXISTING & FUTURE SATELLITE SYSTEMS FOR THE ASIA/PACIFIC REGION: THAICOM, ASIASAT, APSTAR, PANAMSAT, PALAPA, TONGASAT, INSAT & ARABSAT WITH OVERVIEW OF SATELLITE PERFORMANCE CHARACTERISTICS AND RECEPTION REQUIREMENTS.

OCTOBER 23, 1994 - PLENARY SESSION 2
DIGITAL VIDEO COMPRESSION, ENCRYPTION, AND HIGH DEFINITION TELEVISION SYSTEMS FOR THE ASIA/PACIFIC REGION: INCLUDING AN OVERVIEW OF THE COMPLETED MPEG 2.0 COMPRESSION STANDARD AND ITS VARIOUS APPLICATIONS WORLDWIDE.

OCTOBER 24, 1994 - PLENARY SESSION 1
SATELLITE TV PROGRAMMING OPPORTUNITIES IN THE ASIA/PACIFIC REGION: PRESENTATION COVERING NEW TV & RADIO PROGRAM SERVICES FOR THE ASIA/PACIFIC REGION WITH AN OVERVIEW OF EXISTING & FUTURE FREE-TO-AIR, SUBSCRIPTION, AND PAY TV SERVICES AND THEIR ACCOMPANYING COMPRESSION/ENCRYPTION SYSTEMS.

OCTOBER 24, 1994 - PLENARY SESSION 2
LOW EARTH ORBITING SATELLITE SYSTEMS FOR THE ASIA/PACIFIC REGION: PRESENTATION ON PLANNED SYSTEMS SUCH AS IRRIDIUM ALONG WITH CONSUMER APPLICATIONS FOR MOBILE AND HAND-HELD PORTABLE OPERATIONS VIA SATELLITE.

WORKSHOP LEADER BIOGRAPHY — H. TAYLOR HOWARD

In 1955, Henry Tayor Howard graduated from Stanford University with a degree in Electrical Engineering. Following graduation, Mr. Howard spent the next year as a research assistant in the Radio Propagation laboratory continuing work done from 1952 on the design, construction, and operation of HF and VHF meteor radars and directional antennas. His subsequent three years were spent on active duty as an electronics engineering officer (USNR) directing the installation and repair of shipboard communication, navigation, and fire control equipment.

In 1959, he returned to Stanford to work in antenna and transmitter design and research in the field of radio propagation, radar astronomy, inter-planetary gas density, and planetary surfaces. He was responsible for the design, construction, and operation of the Center for Radar Astronomy facility 50 and 25 MHz 300 kilowatt CW radars and the associated antenna systems.

Contributions to the NASA Space Program. Professor Howard has been a NASA Principal Investigator on several Apollo flight experiments and leader of the Mariner 10 Celestial Mechanics and Radio Science team. He is a member of Sigma X1, the American Geophysical Union, the International Scientific Radio Union, American Astronomical Society, a Fellow of the Institute of Electrical and Electronic Engineers, and the author or co-author of over forty journal publications. In 1973 he received the NASA medal for Exceptional Scientific Achievement for his work as Principal Investigator of the Apollo bistatic radar experiment.

Pioneering Contributions to the Development of Home Satellite TV. In 1975, he began private experimentation with video transmission from geostationary satellites. By mid-1976, he created the first home-built, privately-owned C-band receiving system. This led to the 1978 publication of a manual, *The Howard Terminal*, which described the satellite system and took the reader through the construction of a complete satellite TV receiving system. As a result, elements of his pioneering design appear in nearly all of the satellite video receivers now in production.

Continuing private work and consulting led to the invention and development of several very high performance feedhorns for reflector antennas. These are now produced commercially by *Chaparral Communications* of San Jose, California. He is the inventor or co-inventor of seven U.S. and several overseas patents.

In 1980, he became the founding president of the satellite television industry trade association, SPACE, and has served continuously as an officer, director, or chairman. In 1986, SPACE and the Direct Broadcast Satellite Association merged to become the Satellite Broadcasting and Communications Association (SBCA). As Chairman of these organizations, he has been active in providing leadership to the satellite industry and has testified before both the House and Senate Communications Committees on its behalf.

WORKSHOP LEADER BIOGRAPHY — MARK LONG

Mark Long is the world's leading journalist in the field of satellite communications. Mark Long is the author of six books on satellite communications: the best-selling **Down To Earth Guide to Satellite TV**, the **Ku-band Satellite Handbook**, the **1990, 1991, and 1993 World Satellite Annuals**, and the critically-acclaimed **World Satellite Almanac**—the commercial satellite industry's standard reference on satellite systems around the world. He also is the co-author of the million-selling **Big Dummy's Guide to CB Radio,** the best-selling **World of Satellite TV**, and the **Inclined Orbit Satellite Tracking Guidebook**. In addition, he is the author of the **World of Home Video Entertainment**. Nearly two million copies of his various books are in print.

Publisher. As president of MLE INC., Mark Long supervises the publication of a variety of periodicals, including the monthly newsletter *World Satellite Update*, the quarterly *World Satellite Transponder Report*, the *World Satellite Annual, and the Asia/Pacific Satellite Business Directory*. He also has written and appeared in several educational video tapes on satellite technology which are used as part of the curriculum at hundreds of colleges, universities, and vocational schools in the U.S. and abroad.

Consultant. In addition to his work as journalist, author, and publisher, Mark Long regularly provides technical consulting services ranging from feasibility studies, observational reports, and satellite event planning, to the implementation of telecommunications networks and negotiations leading to the purchase of communications satellites. During the early 1980s, he pioneered the concept of using foreign satellite TV programs in the classroom as a language learning aid. His consulting clients include the U.S. Naval Academy, the universities of Pennsylvania, Virginia, and Maryland, the U.S. Information Agency, the Billy Graham Evengelical Association, Comsat Corporation, and London-based Coopers and Lybrandt.

Education and Professional Memberships. Mark Long received his Bachelor's degree from the School of Communications at the *University of Central Florida*. An amateur radio enthusiast (WA4LXC), Mr. Long also is a member of the *American Institute of Aeronautics and Astronautics* and the *International Society of Satellite Professionals*.

A LOOK BACK AT *SATELLITE TV ASIA '93*

Asia's First Home Satellite TV Conference Sets The Stage for New Developments in the Asia/Pacific Region

by Benjamin L. Gaines, Jr., Conference Director

October 27 - 29, 1993, marked the beginning of a new venue for *World Satellite Almanac* publisher MLE INC. Halfway around the world, amidst the paradise-like beauty of the island of Phuket, Thailand, the company organized Asia's first Home Satellite TV Conference. Designed to be beneficial to both newcomers and long- time satellite TV industry professionals alike, the conference was chaired by Mark Long, author of the *World Satellite Almanac* and nine other textbooks on satellite communications. In addition to organizing and chairing the conference, Mr. Long also presented seminars on existing and future satellite systems for the Asia/Pacific Region. More than 200 delegates representing twenty-four nations from around the globe were present.

In his opening remarks to the conference, Mr. Long commented upon his selection of Phuket as the site of Asia's first satellite TV conference. He noted that "early on, many people asked me, why was Phuket selected since it is so far away from Asia's major business centers."

"It is my belief that we must first create an environment for learning, one in which attendees also can relax and enjoy themselves. Only after we get away from our offices and from the everyday pressures that we normally encounter, can we open our minds to new information and unforeseen possibilities."

—Mark Long, Author and Publisher, The World Satellite Almanac

Many attendees echoed their full agreement as they watched the beautiful sunsets over the Andaman Sea from the shores of Phuket's *Kata Beach*. Pace Micro Technology, which imported a large hot air balloon and pilot for the conference, also took delegates and media representatives for aerial rides at sunset and flew the balloon over the hosting Kata Beach Resort at other times of the day.

Satellite TV Asia 93 had a supporting cast of workshop leaders and speakers that included

CQ editor Vichan Thaveekij (left) with Taylor Howard, Mark Long, and Bob Cooper at ***Satellite TV Asia '93.***

"We are glad to have been the sponsor of the session tea breaks....We are impressed by, and most pleased with, the professional management of the conference and the positive response we received from the attendees. On behalf of STAR TV, I would like to congratulate you for a successful conference and commend you for your impressive efforts at setting up the first Asian conference dedicated to home satellite TV technology."

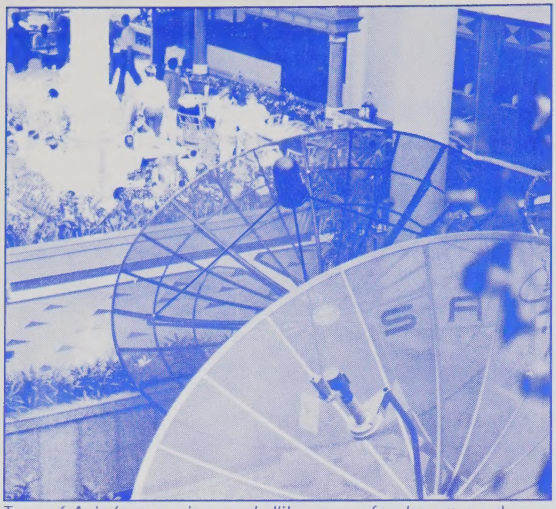
—Andrew Reilly, Marketing Director STAR TV Network

"It was our pleasure to participate in your Satellite Conference at Phuket. We have learned a lot of satellite knowledge in your conference. We also have many new contacts during the exhibition. We are quite sure that we will participate in your next conference."

—Khun Tawatchai and Khun Udom Samart International.

"I would like to express my thanks to you all for the conference in Phuket. I personally found the conference rewarding and stimulating, and the chance of sharing ideas and experiences with others in the same industry was an unexpected bonus."

—Geoff Dargie, Managing Director, Nationwide Antenna Systems of Australia.



*Ten of Asia's premiere satellite manufacturers and distributors exhibited at **Satellite TV Asia '93** in Phuket.*

industry pioneers such as Stanford Professor and NASA Consultant H. Taylor Howard, American Home Satellite TV guru Bob Cooper, and Jeffrey Keating, co-author of the best-selling *World of Satellite TV* and *Inclined Orbit Satellite Tracking Guidebook.*

H. Taylor Howard, who is credited with building the world's first C-band satellite TV receiving system, provided attendees with detailed technical overviews on antenna and feedhorn systems, and digital video compression. Bob Cooper, the TVRO pioneer who started it all with his landmark 1978 TV Guide article on satellite TV reception, provided an overview of the history of satellite TV and led a technical seminar on the installation and servicing of cable and SMATV systems. Mr. Cooper organized the very first Home Satellite TV Conferences ever held in the United States.

Satellite TV Asia '93 marked the first time that Bob Cooper and H. Taylor Howard had shared the same stage in more than seven years. Several attendees commented that they also felt as if they were on hand for a historic occasion, given the remarkable background of these two pioneers.

Drawing on his fifteen years' experience in the cable, SMATV, and satellite TV fields, Jeffrey Keating presented key seminars concerning the installation of satellite TV systems and the mechanics of inclined orbit satellite tracking, a major requirement for the reception of satellite TV services in many parts of the Middle East and the Pacific Rim.

Other presenters included keynote speaker Dr. Avudh Ploysongsang—Senior Manager of the Commercial Department for Shinawatra Satellite—who briefed attendees on Thailand's Thaicom satellite system; Mr. Steve McHugh, Vice President, STAR TV, who spoke on the subject of pay TV in Asia; Jim Beveridge of Pace Micro Technology, who gave an overview on Satellite Encryption; and Mr. Charoenrath Vilailuck, President of Samart International, who instructed attendees concerning satellite receiver requirements for the Asia/Pacific Region. A round table discussion of Asia/Pacific equipment manufacturers included Bob Taggart of Chaparral Communications; Mike Davis of Echosphere Corporation; Brian Chan of Pan Asian Systems; Joseph Yeung of Pacific Satellite Int.; and Raymond Li of Skawol (Bangkok) Ltd.

Satellite TV Asia '93 also featured a One Day Basic Workshop, designed to enlighten newcomers to the industry; the Workshop also was attended by professionals seeking a review of the basic tenets of satellite TV technology. The Workshop discussed topics such as the History of Satellite Communications - Satellite Orbits - Frequency Bands - Interpreting Satellite Footprints - Overview of Existing International, Regional, and Domestic Satellite Systems - and more. The Workshops also provided basic information on individual satellite system components.

Numerous satellite dishes were set up both in front of the Kata Beach Resort Hotel and inside the main lobby's spacious tropical atrium. Sponsoring companies who chose to exhibit their products included STAR TV (Asia's premiere satellite TV programmer), Echosphere International, Pan Asian Systems, Samart International, Chaparral Communications, Pacific Satellite International, Pace Micro Technology, Skawol/Kaultronics, Tee-Comm Electronics, Inc., Comstar Co., Ltd., P.T. Kwintercom, and the Satellite Business Development Organization of Thailand (SBDT). Thai publisher CQ International also gave all attendees a free copy of the new Thai-language edition of the *World of Satellite TV.*

Based on the positive response of both the delegates and the sponsors, MLE INC has announced that its next conference and exhibition, **Satcom Asia '94**, will be held at the Empress Hotel and Convention Centre in Chiang Mai, Thailand, on October 22 - 24, 1994. Situated in the cool, mountainous North of Thailand, Chiang Mai is well known for its friendly people and exotic "Lanna Thai" heritage. One of Thailand's most interesting cities, Chiang Mai offers a blend of modern convenience and ancient tradition, from an international airport and the famous Night Bazaar, to the breathtaking mountaintop vistas at Wat Doi Sutep and the fabulous Royal Gardens at Puping Palace.

EARLY REGISTRANTS WILL RECEIVE A FREE COPY OF OUR LATEST PUBLICATION UPON ARRIVAL IN CHIANG MAI

The '94/95 Asia/Pacific Satellite Business Directory

from the Publisher of the World Satellite Almanac

The most detailed, up-to-date information on ***the Region's Present and Future International, Regional, and Domestic Satellite Systems*** *to be found in any publication.*

Country-By-Country Listings *for companies and governmental organizations based in Asia, Australia, and the Pacific Rim.*

A Compact, Portable Resource *on all the region's satellite business activity that also allows you to quickly identify suppliers and potential customers. 354 pp. perfect bound.*

National Profiles *that supply, at a glance, the most important facts that you need to conduct business in each country within the Asia/Pacific Region.*

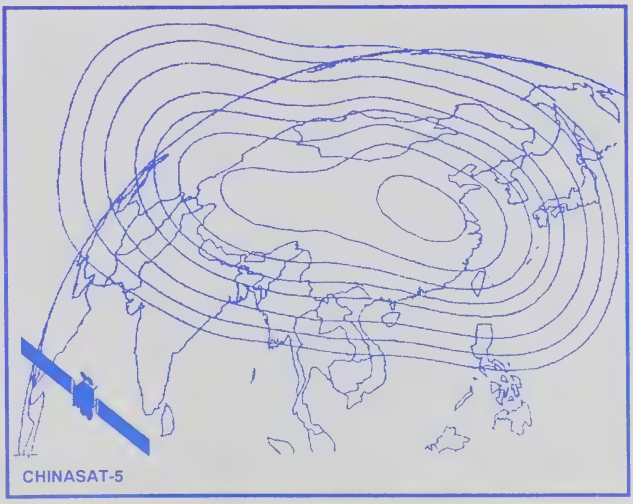
The World's only comprehensive ***Transponder-By-Transponder Analysis*** *that tells you what's on satellite throughout Asia and the Pacific Rim and how to contact the region's satellite operators, programmers, and service organizations.*

A ***Personnel Directory Index*** *identifying key Asia/Pacific satellite communications executives.*

A Yellow Pages section organized under satellite ***Product and Service Categories.***

CAN'T WAIT UNTIL THE SATCOM ASIA '94 CONFERENCE IN CHIANG MAI?

Order your copy today for US$ 75.00 plus US$ 30.00 for express courier delivery. Mastercard/Visa/Company Check in US$ drawn on U.S. Bank. Send us a copy of your paid invoice and we will ***deduct US$ 75*** *from your conference registration.*



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MLE INC.

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MLE INC
Post Office Box 159
Department SATCOM ASIA '94
Winter Beach, Florida 32971 USA
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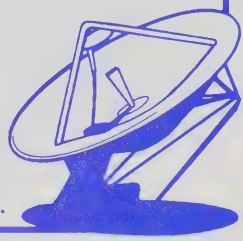
SATCOM ASIA '94

CONFERENCE REGISTRATION FORM
OCTOBER 22 - 24, 1994

THE EMPRESS CHIANGMAI

ORGANIZED BY MARK LONG ENTERPRISES, INC.



TAKE ADVANTAGE OF OUR EARLY REGISTRATION RATES AND RECEIVE A FREE COPY OF THE NEW *ASIA/ PACIFIC SATELLITE BUSINESS DIRECTORY* WHEN YOU ARRIVE IN CHIANG MAI!

ALL PACKAGES PRESENTED (RIGHT) INCLUDE A HOTEL ROOM AT THE EMPRESS CHIANG MAI, INCLUSIVE OF BREAKFAST.

Please select one of the four available conference registration packages presented (right). All packages include hotel accomodations, inclusive of breakfast, and free passes to all conference functions, including coffee/tea breaks, luncheons and the welcoming cocktail party. If you do not wish to have a room at the Empress Chiang Mai, or will be sharing a double room with another attendee, you may deduct US$ 100.00 from the prices presented below. (All conference attendees will be responsible for any and all additional charges to their rooms beyond the nightly room rate, such as telephone calls, mini-bar, and room service.)

BILLING INFORMATION

- ☐ A check in U.S. $ drawn on a U.S. Bank for the amount indicated (right) has been enclosed.
- ☐ I have initiated a Bank Wire Transfer as specified below.
- ☐ Please bill company P.O. #_____
- ☐ Please bill my Credit Card. **(MASTERCARD/VISA ONLY!)**

Acct#_____Exp._____
Signature _____

BANK WIRE TRANSFERS: For a US$ 15 fee, attendees can wire funds in US$ to the following bank account: Mark Long Enterprises, Inc./Acct.# 0160426001, Indian River National Bank #63-1205/670, 958 20th Place, Vero Beach, FL 32960

☐ Please Deduct US$ 100 from my conference registration fee as I will not require my own room at the Empress Chiang Mai during the conference.

BASIC WORKSHOPS & PLENARY SESSIONS
October 22, 23, & 24, 1994

(Please select one of the following packages:)

☐ **Satcom Asia '94 Platinum**

Conference Registration for the Basic Workshops of October 22 and the Plenary Sessions of October 23 and 24, 1994 and a single room for the nights of October 21, 22, 23, and 24. US$ 550.00 if registration is received prior to August 1, 1994, or US$ 650.00 thereafter.

☐ **Satcom Asia '94 Platinum Plus**

Conference Registration for Basic Workshops of October 22 and the Plenary Sessions of October 23 and 24, 1994 and a double room for the nights of October 21, 22, 23, and 24. US$ 600.00 if registration is received prior to August 1, 1994, or US$ 700.00 thereafter.

PLENARY SESSIONS ONLY
October 23 & 24, 1994

☐ **Satcom Asia '94 Gold**

Conference Registration for Plenary Sessions of October 23 and 24, 1994 and a single room for the nights of October 22, 23, and 24. US$ 425.00 if received prior to August 1, 1994, or US$ 525 thereafter.

☐ **Satcom Asia '94 Gold Plus**

Conference Registration for Plenary Sessions of October 23 and 24, 1994 and a double room for the nights of October 22, 23, and 24. US$ 475.00 if received prior to August 1, 1994, or US$ 575.00 thereafter.

Name _____
Company _____
Address _____
City_____State_____
Country_____Zip_____
Telephone _____ Fax_____

SATELLITE TV ASIA '93

Kata Beach Resort
PHUKET, THAILAND
October 27, 28, & 29

FINAL SCHEDULE OF EVENTS

The following is a schedule of events planned as of October 12, 1993. Delegates will be notified in Phuket of any additions or revisions to the below schedule.

Wednesday, October 27, 1993

OPTIONAL ONE-DAY BASIC WORKSHOP

Workshop leaders: Mark Long, H. Taylor Howard, Robert Cooper, Mike Davis, & Jeffrey Keating.

Those attendees who are newcomers to home satellite TV—and experienced professionals who would like to review the basic concepts of satellite TV technology—are encouraged to attend this one-day optional basic overview course. Attendance will be limited to no more than 40 persons per workshop to keep class size small enough to allow the maximum amount of interaction between Workshop leaders and the audience. Early registration is therefore advised if you wish to attend. Workshop supporting materials provided to each attendee free of charge.

SESSION I: The Space Segment, Programming Options & Regulatory Concerns.

9:00 a.m. - 12: 30 p.m. (Break 10:45 - 11:00 a.m.)

History of Satellite Communications - Satellite Orbits - Satellite Communications Payloads - The Satellite Frequency Bands - Satellite Power Considerations - Interpreting Satellite Footprints - Overview of Existing International, Regional, and Domestic Satellite Systems - Programming Resources - Regulatory Concerns. Includes 45 minutes for questions and other interaction between Workshop leaders and the audience.

12:30 - 1:30 p.m. Lunch Break.

SESSION II: The Ground Segment: An Overview of Basic Satellite TV Receiving Components

1:30 p.m. - 5:00 p.m. (Break 3:30 - 3:45 p.m.)

LNBs, Feedhorns, and Antennas - System Noise Temperature Considerations - Receivers - Multistandard TVs, VCRs, and Converters - Encryption, Descramblers, and Integrated Receiver Descramblers - Accessories - System Component Integration Considerations. Includes 45 minutes for questions and other interaction between Workshop leaders and the audience.

8:00- 9:00 p.m. One Hour Open Bar.

Attendees are invited to attend MLE's welcoming cocktail party at the Kata Beach Resort's poolside bar.

Thursday, October 28, 1993

MORNING SESSION — Taking Strides Toward the Future

9:00 - 9:30a.m. — **Opening Ceremony**: Report on the State of the Home Satellite TV Industry in Asia, Australia, and the Middle East.

9:30 - 10:15 a.m. — **Future Satellites for the Asia/Pacific Region** (Part I). Thailand's Thaicom satellite system. Presented by Dr. Avudh Ploysongsang, Senior Mgr., Commercial Dept., Shinawatra Group.

10:15 - 10:45 a.m. — Morning Tea/Coffee Break courtesy of STAR TV. Exhibits area open.

10:45 - 12:00 — **Future Satellites for the Asia/Pacific Region** (Part II). Asiasat-2, Apstar, Palapa C, Intelsat VII, PAS, and Russain Coupon satellite systems. Presented by Mark Long and Tim Brewer.

12:00 - 1:00 p.m. Luncheon Sponsored by MLE INC.

Thursday, October 28, 1993

AFTERNOON SESSION — Coping With Specialized Technologies

1:00 - 1:45 p.m. — **Satellite Encryption Overview.** Presented by Jim Beveridge of Pace Micro Technology

Ltd. Includes discussions of encryption systems with an emphasis on technical requirements for gaining and maintaining subscription access.

1:45 - 2:30 p.m. — **Pay TV Via Asiasat.** Mr. Steve McHugh, STAR TV's Vice President of Network Development, Pay Television discusses STAR TV's newly proposed pay television channels and their anticipated impact on the Asian market.

2:30 - 3:00 p.m. — Afternoon Tea/Coffee Break, courtesy STAR TV, Exhibits area open.

3:00 - 3:30 p.m. — **Understanding Digital Video Compression.** Videotaped interviews with representatives of some of the leading developers of compression systems that includes a discussion of the impact of MPEG 2. Produced by Shelburne Films.

3:30 - 4:00 p.m. — **Mechanics of Inclined Orbit Satellite Tracking.** Jeffrey Keating, co-author of the *Inclined Orbit Satellite Tracking Guidebook* provides an overview of inclined orbit satellites, how to predict orbital inclination, tracking techniques, and the available hardware/software.

4:00 - Exhibits Area Open

Friday, October 29, 1993

MORNING SESSION — Towards Maximizing Performance

9:00 - 10:00 a.m. — **Satellite System Design.** Presented by MLE President Mark Long, author of the *World Satellite Almanac.* Includes satellite footprint interpretation, the calculation of a "downlink budget", and the selection of satellite components.

10:00 a.m. - 11:00 p.m. — **Satellite Antenna and Feedhorn Requirements**. Presented by H. Taylor Howard, Director of Research, Chaparral Communications. Includes a detailed presentation of the technical parameters involved in the design, selection, and installation of satellite antennas and feedhorns.

11:00 - 11:30 a.m. — Morning Tea/Coffee Break, courtesy STAR TV. Exhibits Area Open.

11:30 - 12:00 p.m. — **The Lessons of History.** Relates the evolution of the American TVRO industry to what changes the Asian marketplace is likely to experience in the years ahead. Presented by Robert Cooper, Coop's Technical Digest (New Zealand).

12:00 - 1:00 p.m. — Lunch Break. Exhibits Area Open.

Friday, October 29, 1993

AFTERNOON SESSION — Towards Maximizing Performance (Continued)

1:00 - 1:45 p.m. — **Satellite Receiver Requirements.** Includes a review of the various idiosynchrasies associated with satellite reception: varying transponder frequency plans, polarizations, video and audio standards, and the appropriateness of dual-band capabilities for various areas within the region. Presented by Mr. Charoenrath Vilailuck, President of Samart International.

1:45 - 2:30 p.m. — **Home Satellite and SMATV Installation Overview.** Includes the discussion of installation problems for home TVRO and SMATV systems and their solutions. Techniques for system peaking and tracking using various test equipment and alignment tools. Presented by Mark Long and Jeffrey Keating of MLE INC.

2:30 - 3:00 p.m. — Afternoon Tea/Coffee Break, courtesy of STAR TV. Exhibits Area Open.

3:00 p.m. - 4:30 p.m. **Asia/Pacific Equipment Manufacturers and Distributors Roundtable Discussion.** An equipment overview and question and answer session chaired by Taylor Howard, Chaparral Communications. Participants include Art Goldstein, Tee-Comm Electronics, Mike Davis, Echosphere Corporation, Brian Chan, Pan Asian Systems, Nigel Moore-Wainwright, Pace Micro Technology, Ltd., Joseph Yeung, Pacific Satellite International, and Raymond Li, Skawol (Bangkok) Ltd.

4:30 p.m. - Closing Ceremony

Thai-language Translations

Headphones are available upon request for attendees who wish to listen to seminars the Thai-language. Thai-language translation equipment organized by *Thai Vasco (1977) Ltd.* Thai translators: courtesy *CQ International and Echosphere Corp.—Asian Division (Singapore).*

HOME SATELLITE TV ASIA '93

The following is a brief set of biographies of speakers at *Home Satellite TV Asia '93.*

H.TAYLOR HOWARD. (Chaparral Communications)

A graduate from Stanford University in 1955 with a degree in Electrical Engineering, ***Henry Taylor Howard*** entered into research in HF and VHF meteor radars and directional antennas.

Professor Howard is a true pioneer in the field of home satellite communications. By mid-1976, he created the first home-built C-band receiving system. From this beginning, he has gone on to become the Chairman of the Satellite Braodcasting and Communications Association.

Professor Howard also has been involved in the NASA Space Program, and has written or co-written over forty journal publications. Currently, Professor Howard serves as Vice Chairman for San Jose-based Chaparral Communications.

MARK LONG. (Mark Long Enterprises, Inc.)

With over 300 articles written on the subject of satellite communications over the course of ten years, ***Mr. Mark Long*** also is the author of the best-selling **Down To Earth Guide to Satellite TV**, the **Ku-band Handbook**, the **1990, 1991,** and **1993 World Satellite Annuals**, and the **World Satellite Almanac.** Mr. Long also is co-author of the **Big Dummy's Guide to CB Radio,** the **World of Satellite TV,** the **Inclined Orbit Satellite Tracking Guidebook,** and as President of **MLE Inc.,** supervises the publication of the monthly newsletter **World Satellite Update** and the quarterly **World Satellite Transponder Report,** along with the production of several videotapes on satellite communications.

Mr. Long received his Bachelor's degree from the School of Communications at the University of Central Florida. He continues to write and to give lectures at various colleges and universities, and has won consulting contracts for several large communications installations and companies.

JEFFREY KEATING. (Mark Long Enterprises, Inc.)

The co-author of such best-sellers as the **Big Dummy's Guide to CB Radio**, the **World of Satellite TV**, and the **Inclined Orbit Satellite Tracking Guidebook**, ***Mr. Jeffrey Keating*** is a consultant in satellite communications. Mr. Keating worked in radio communications as

a FM station broadcast manager, broadcast TV and radio programming programming advisor, and as an amateur radio net control operator for relief efforts in Central America.

Mr. Keating also has provided companies with advice on the transmission and reception of video, voice, and data. He has a partnership with a Venezuelan firm which has installed a VSAT business communications system for Latin America through the PAS-1 satellite.

CHAROENRATH VILAILUCK. (Samart International)

Currently serving in various positions in the widespread Samart group of companies, ***Mr. Charoenrath Vilailuck*** is the president of Samart Corporation Public Company, president of Samart International Co., Ltd., a VP of Samart Satcom Co., Ltd., VP of Samart Engineering Co., Ltd., VP of Samart Cable Network Co., the Vice Chairman of Cambodia Samart Co. Ltd., and on the Board of Directors of Samart Telecom Co. Ltd.

Mr. Vilailuck attended Sydney Technical College (Australia), and is a graduate of New Castle University in Australia.

JIM BEVERIDGE. (Pace Micro Technology)

Jim Beveridge joined Pace from News Datacom where he was involved in Videocrypt conditional access technology. In a previous role with Motorola Semi Conductors, Mr.Beveridge held a variety of sales and marketing positions in the United Kingdom and Germany.

At Pace, Mr.Beveridge fills the newly created position of Business Development Manager for the Pay TV sector. In a global marketplace with systems currently being installed in places as diverse as Argentina, Indonesia, Iceland, and Nigeria, Mr.Beveridge's role involves advising broadcasters and programmers on how they can best implement secure Pay TV systems.

MIKE DAVIS. (Echosphere Corporation)

Prior to working at Echosphere, ***Mr.Mike Davis*** performed engineering and system support for guidance and control systems. He received an MPA from the University of Colorado in 1988 specializing in Science & Technology and in Space Policy. Mr.Davis has been employed at Echosphere since 1988, and has since defined operational user interfaces for fixed European satellite receivers in addition to writing the service and operating manuals for Echosphere's product line.

Mr.Davis has experience with managing the design and manufacturing interfaces with multiple vendors throughout S.E.Asia. He determines the requirements for new Asian products and feature enhancements and manages Asian development issues for all new products. In Singapore, Mr.Davis conducts field testing for all new products along with Sales Training and benchmarking.

SATELLITE TV ASIA 93 - BASIC WORKSHOPS

IN-ORBIT ASIA/PACIFIC SATELLITE SYSTEMS

1. INTERNATIONAL SATELLITE SYSTEMS

    INTELSAT - INDIAN & PACIFIC OCEAN REGIONS

2. REGIONAL SATELLITE SYSTEMS

    ASIASAT-1 - PALAPA B - ARABSAT - RIMSAT
    TDRSS (COLUMBIA COMM./TRW)

3. DOMESTIC SATELLITE SYSTEMS (C-BAND)

    CHINASAT - INSAT - STATSIONAR

4. DOMESTIC SATELLITE SYSTEMS (KU-BAND)

    OPTUS A/B - BS-3A/3B - JCSAT - SUPERBIRD

SATELLITE TV ASIA 93 - BASIC WORKSHOPS

SATELLITE SYSTEM ANALYSIS

I. SATELLITE COVERAGE AREA (FOOTPRINTS)

A. UPLINK VERSUS DOWNLINK

B. POWER LEVELS (EFFECTIVE ISOTROPIC RADIATED POWER - EIRP)

1. EIRP, CALCULATION OF

2. CONVERTING EIRP TO DISH SIZE/LNB NOISE TEMPERATURE

C. INTENDED VERSUS SPILL-OVER COVERAGE

1. PREDICT MODELS VERSUS THE REAL WORLD

2. FIELD REPORTS FROM LOCAL AREA

3. INTERPOLATION USING A SPECTRUM ANALYSER

SATELLITE TV ASIA 93 - BASIC WORKSHOPS

SATELLITE SYSTEM ANALYSIS

D. EFFECTIVE RECEPTION AREA

1. DISH ELEVATION ABOVE HORIZON

2. CONTOUR EIRP VALUE

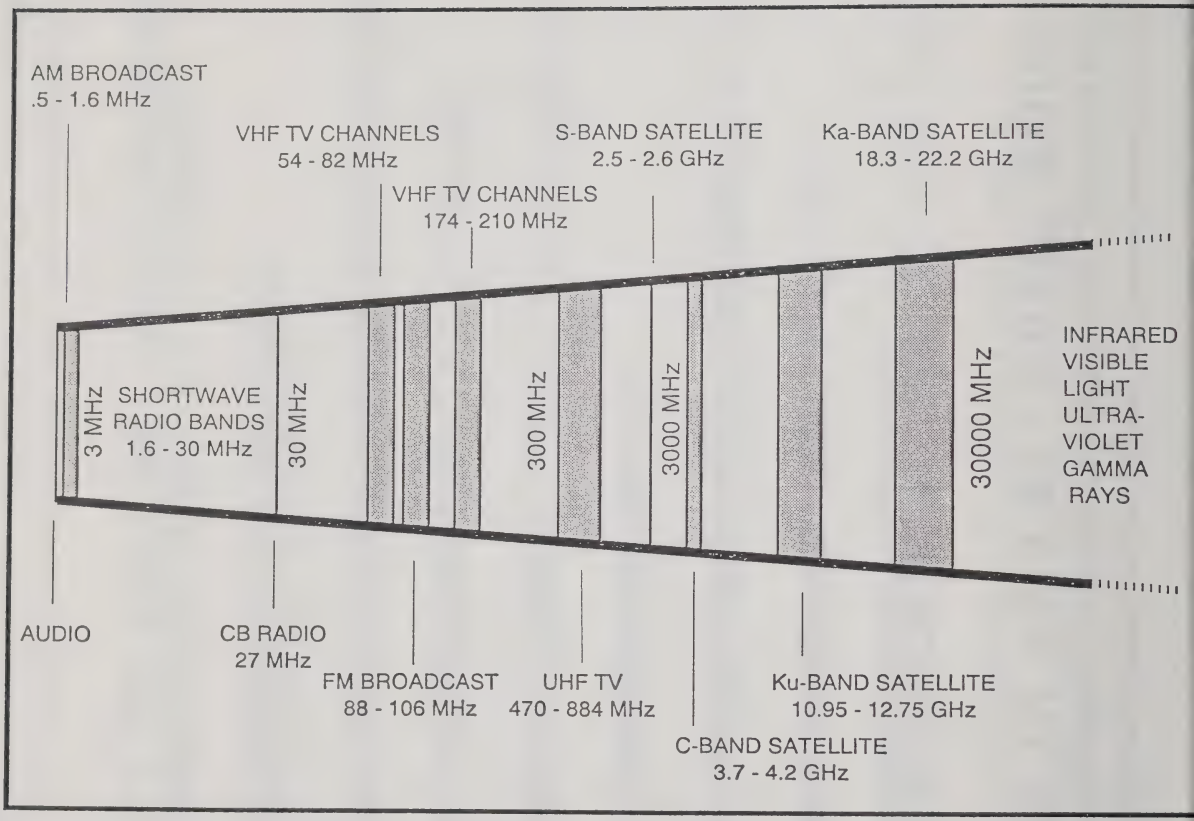
II. SATELLITE BEAM DIVERSITY

A. GLOBAL, HEMISPHERIC, ZONE & SPOT BEAMS

B. BEAM SPATIAL ISOLATION FOR FREQUENCY REUSE

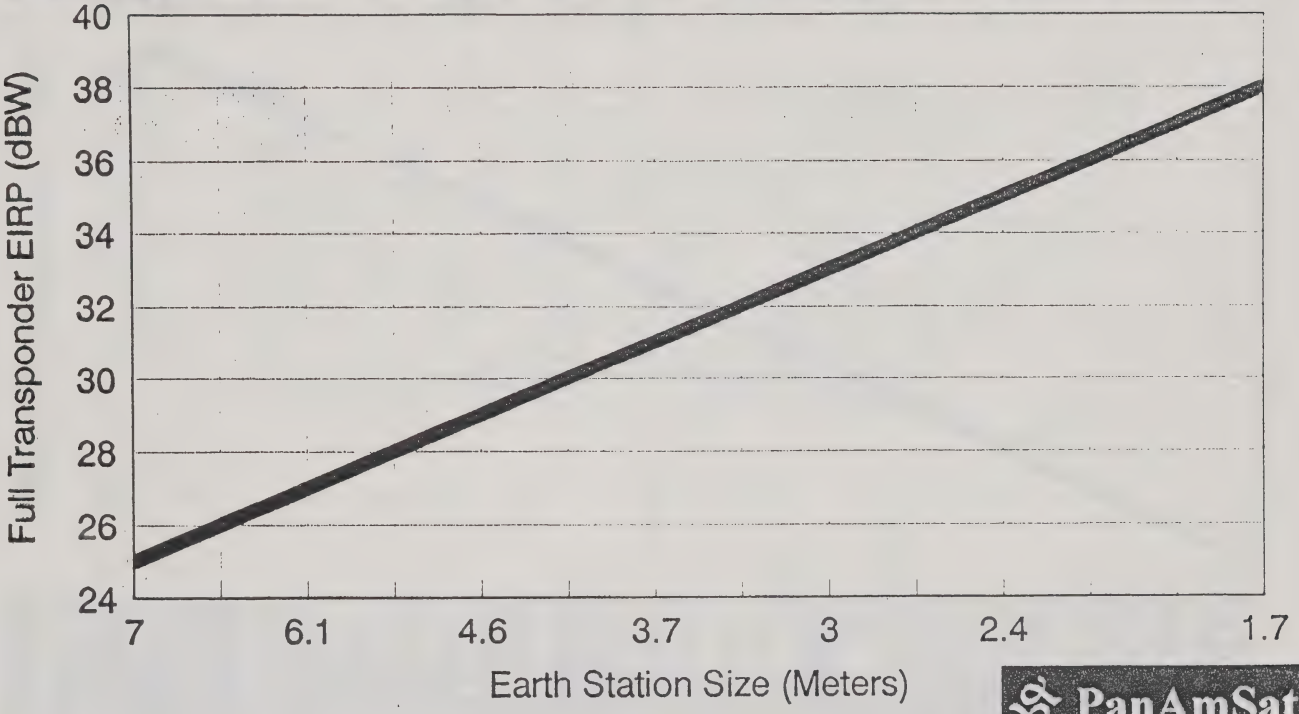
III. TRANSPONDER CAPACITY & BANDWIDTH

IV. SATELLITE FREQUENCY BANDS - C, KU, & S BAND



THE ELECTROMAGNETIC SPECTRUM

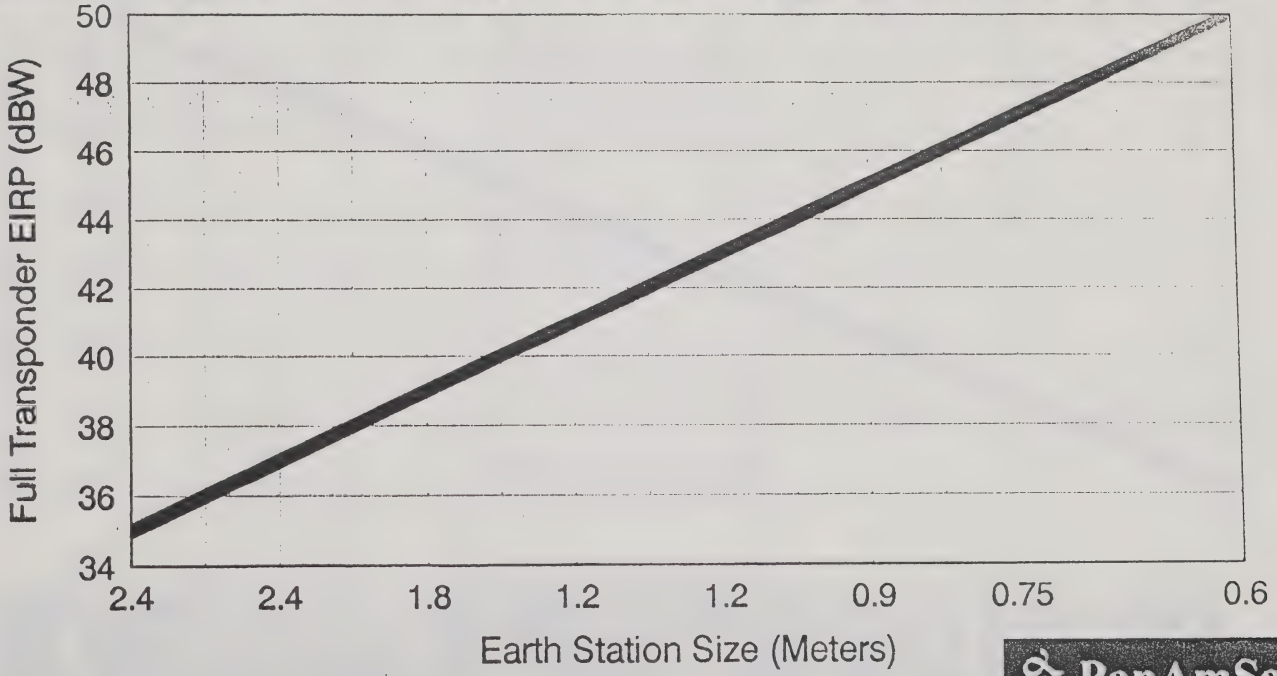
C-band Earth Stations



Compressed Digital Video or Direct-to-Home Analog

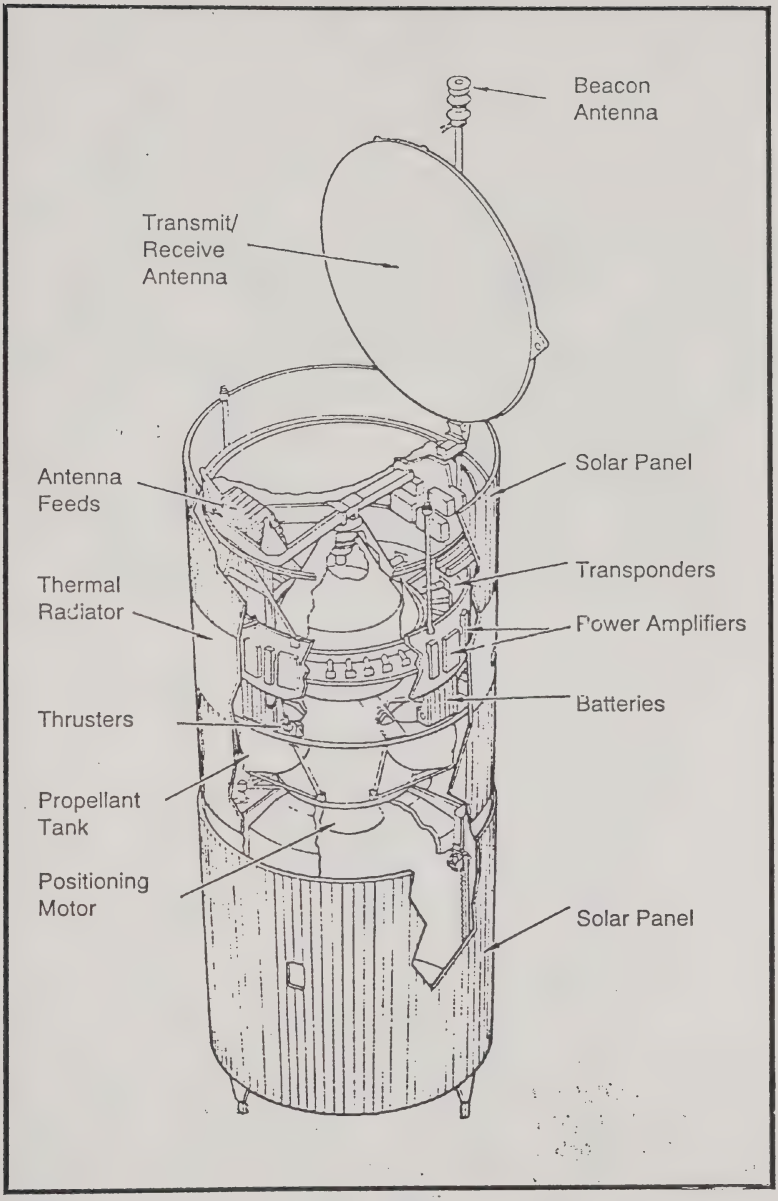
PanAmSat

Ku-band Earth Stations



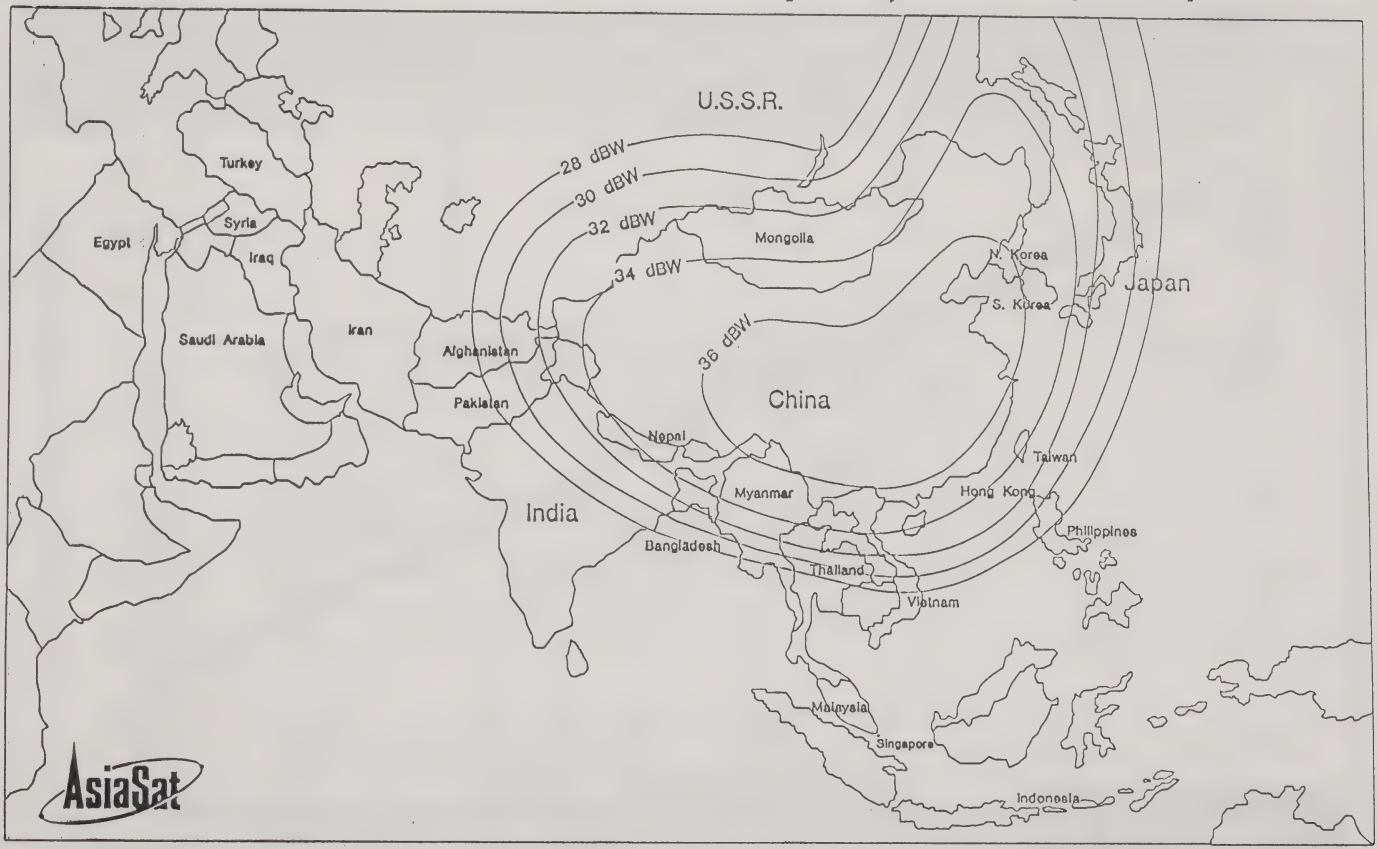
PanAmSat

Compressed Digital Video or Direct-to-Home Analog

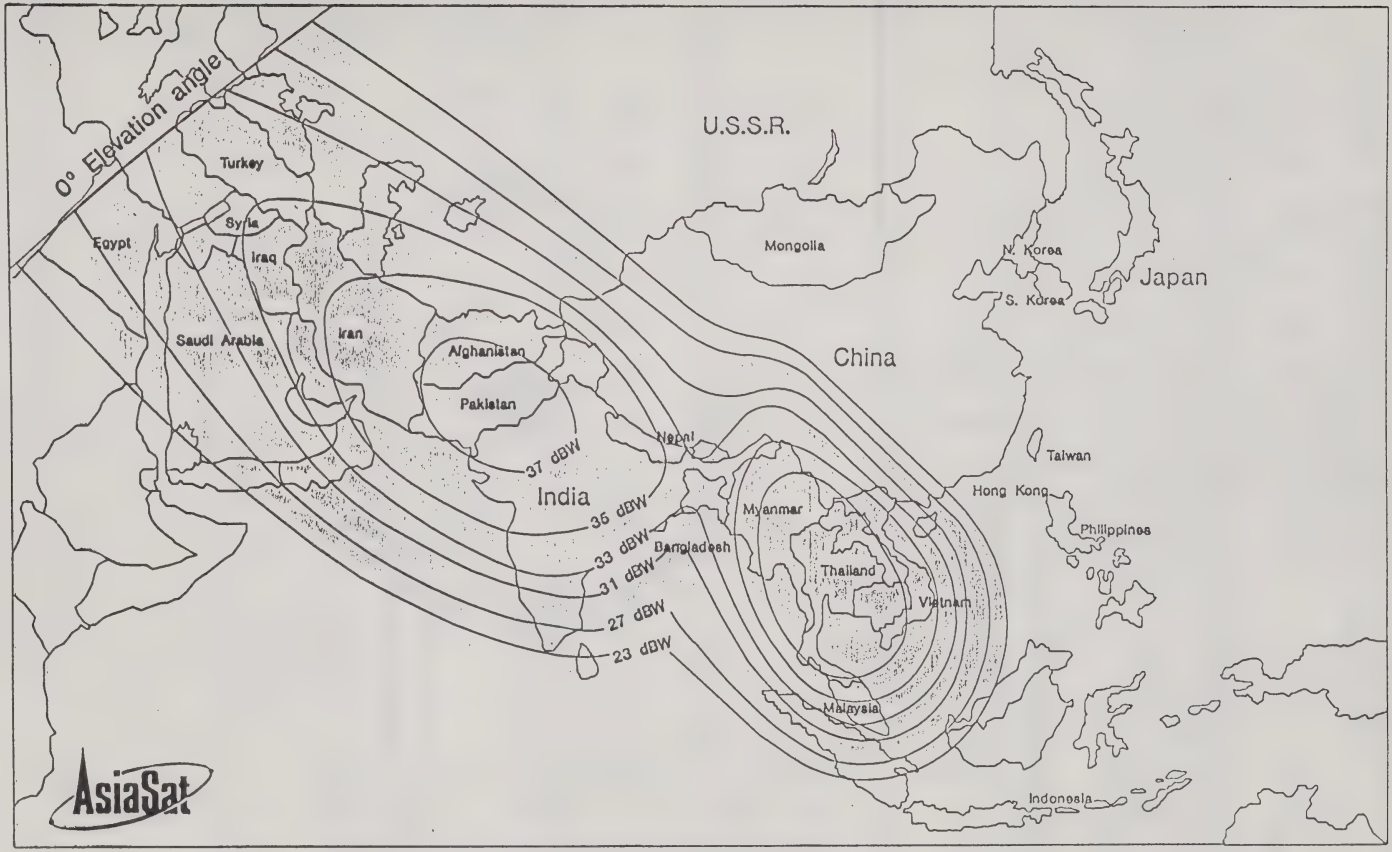


ANIK C1 STRUCTURAL LAYOUT

ASIASAT 1 Northern Footprint, EIRP (dBW)



ASIASAT 1 Southern Footprint, EIRP (dBW)



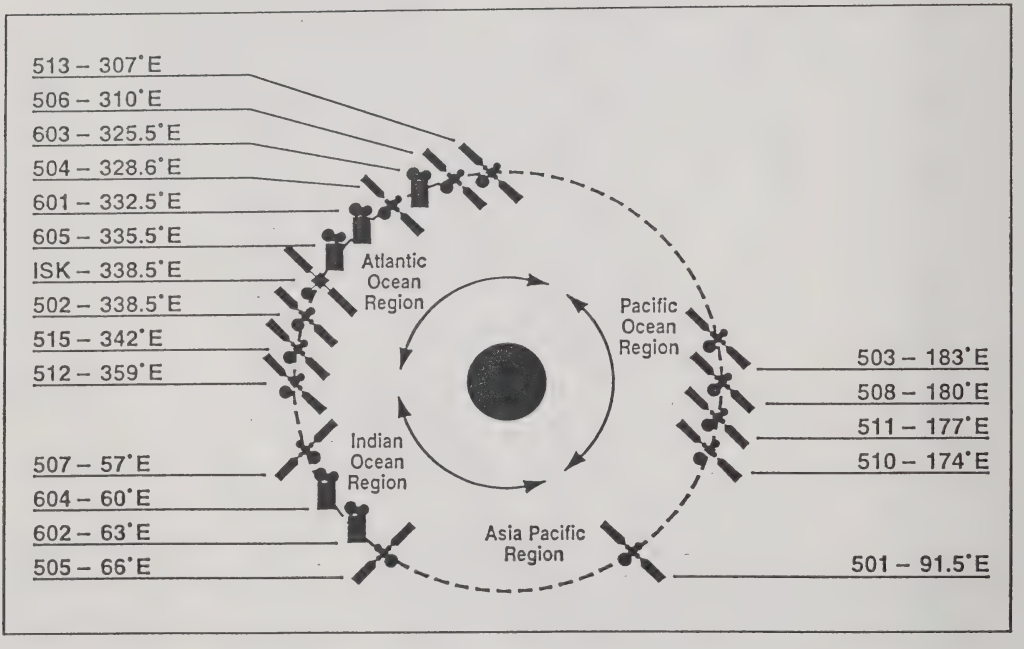
INTELSAT SYSTEM COVERAGE MAPS

INTELSAT

INTELSAT is an international enterprise of over 120 member countries which owns and operates a fleet of 19 satellites over the Atlantic, Indian and Pacific Oceans — the most extensive commercial satellite system in the world. The major provider of transoceanic telephone and television services, INTELSAT also offers international videoconferencing, facsimile, data and telex as well as services on a domestic and regional basis. With more than 25 years of experience, INTELSAT provides unsurpassed quality, reliability and technical expertise to its customers in 180 countries and territories.

Current Satellites in Orbit (March 1993)

INTELSAT's global system of 19 satellites currently is comprised of 13 INTELSAT V/V-A spacecraft, five INTELSAT VIs and the INTELSAT K satellite.



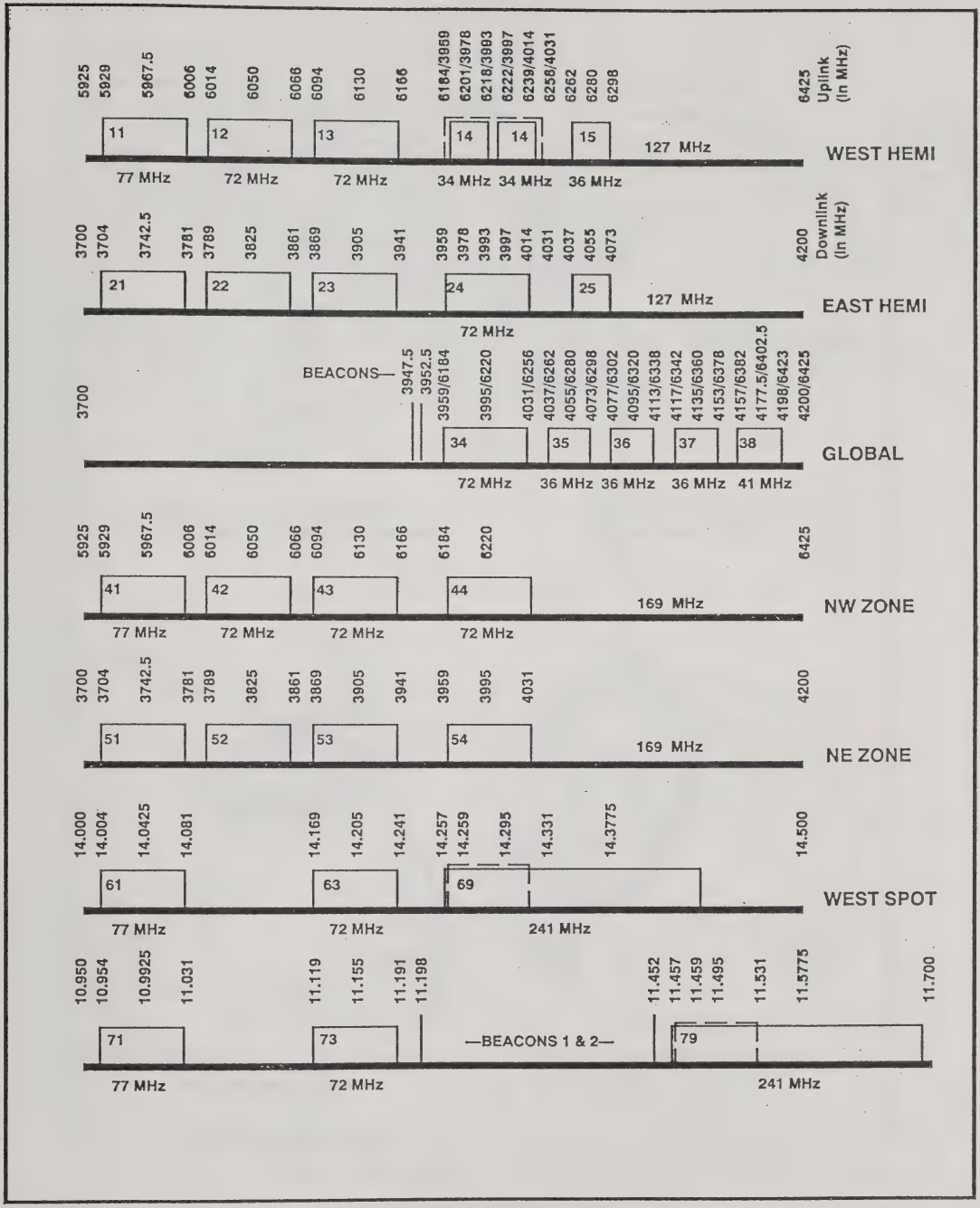


Fig.8-4. INTELSAT V FREQUENCY AND BEAM PLAN

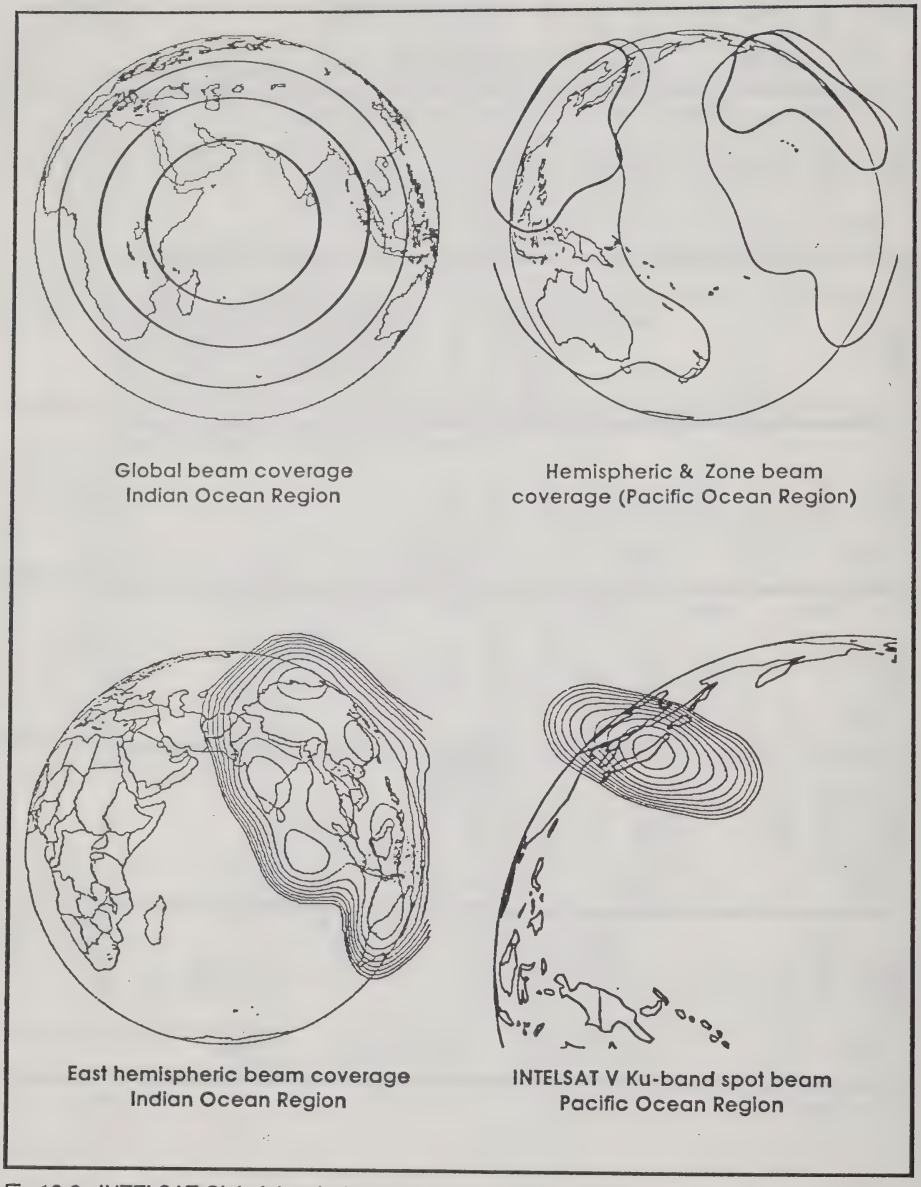


Fig.12-2. INTELSAT Global, hemispheric, zone and spot beam coverage.

Coverage
Maps
for Current
Satellites
in the
Indian Ocean Region

INTELSAT 507 at 57°E

C-Band

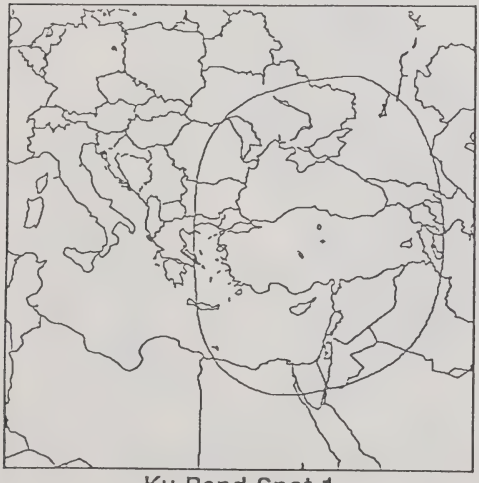
Ku-Band West Spot

Ku-Band East Spot

Coverage
Maps
for Current
Satellites
in the
Indian Ocean Region

INTELSAT 604 at 60°E

C-Band



Ku-Band Spot 1

Ku-Band Spot 2

Coverage
Maps
for Current
Satellites
in the
Indian Ocean Region

INTELSAT 602 at 63°E

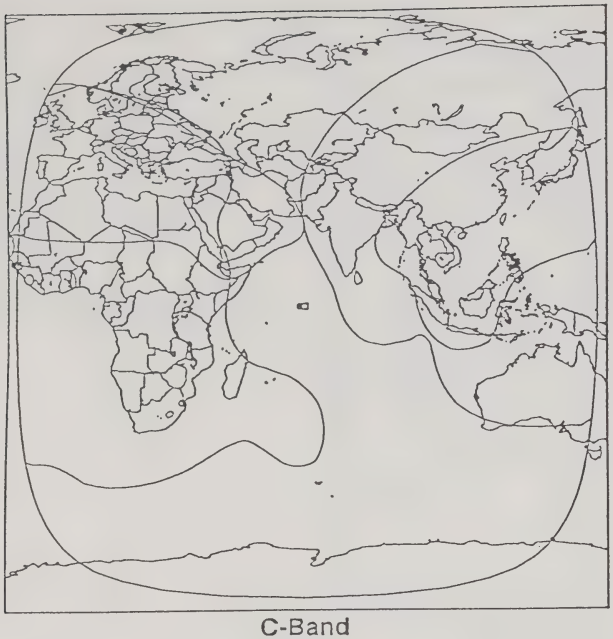
C-Band

Ku-Band Spot 1

Ku-Band Spot 2

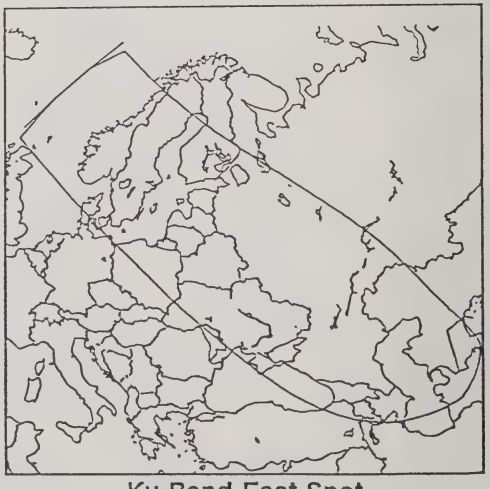
Coverage
Maps
for Current
Satellites
in the
Indian Ocean Region

INTELSAT 505 at 66°E



C-Band

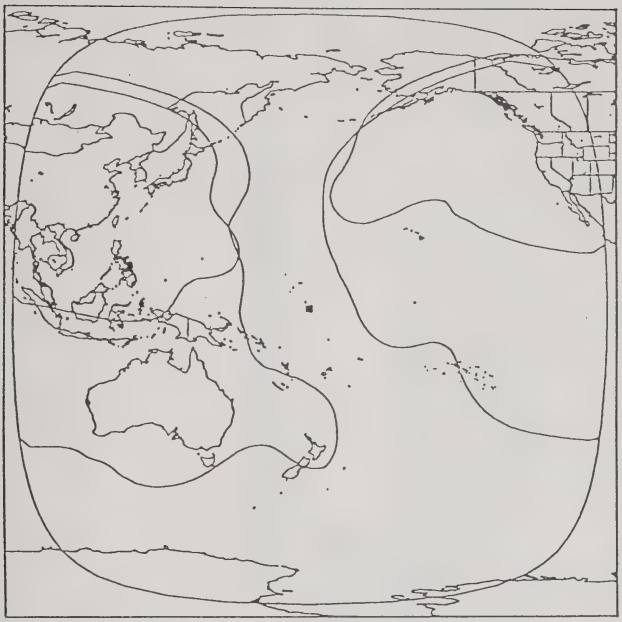
Ku-Band West Spot



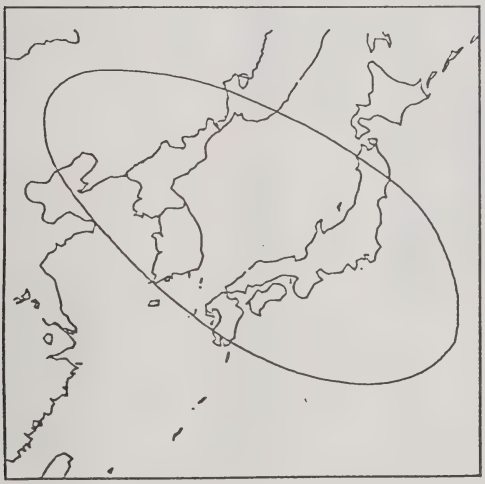
Ku-Band East Spot

Coverage Maps for Current Satellites in the Pacific Ocean Region

INTELSAT 510 at 174°E



C-Band



Ku-Band West Spot

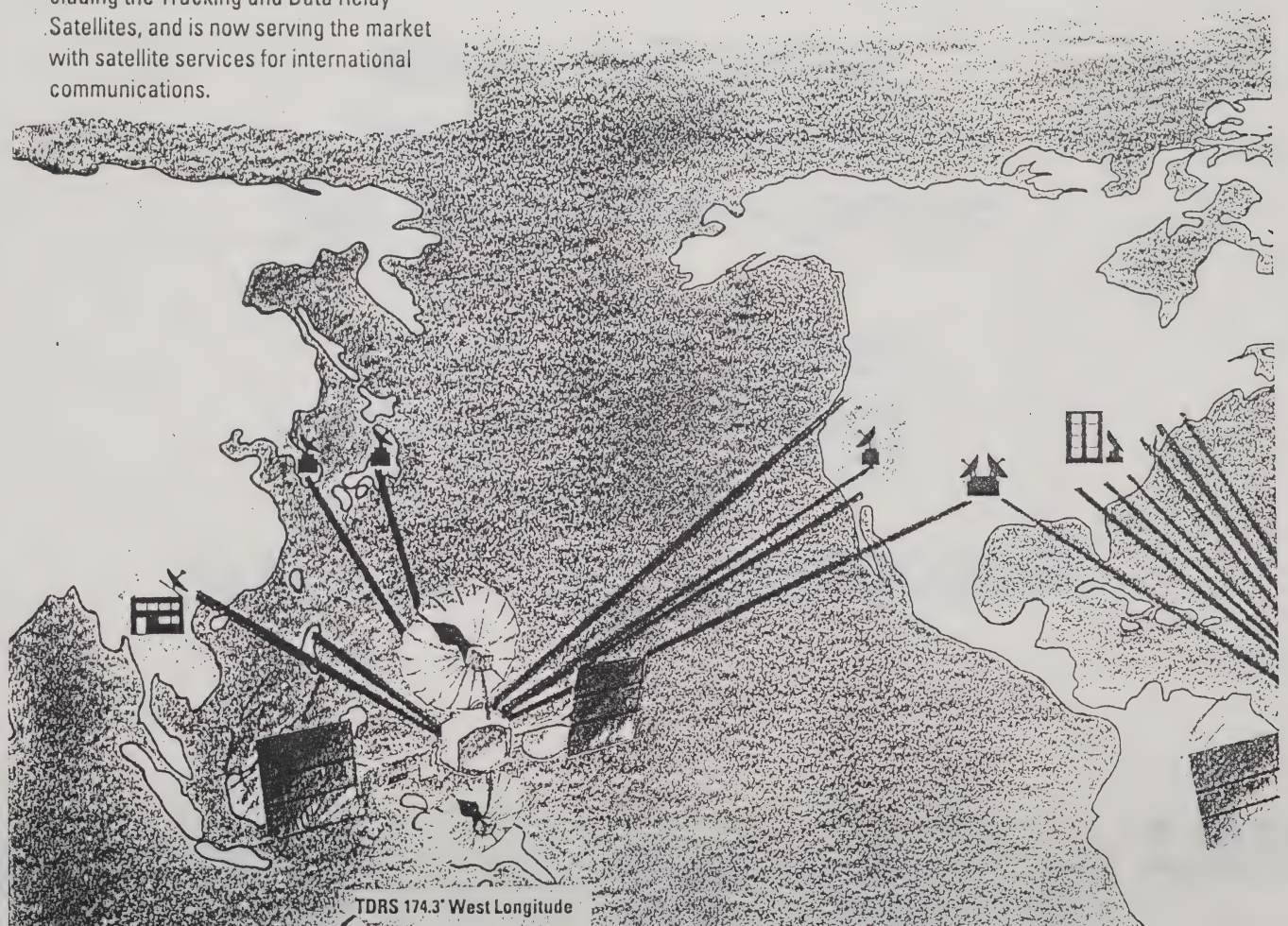
Ku-Band East Spot

TRW

TRW Provides Transponder Service on the TRW-built TDRS-185.7 East

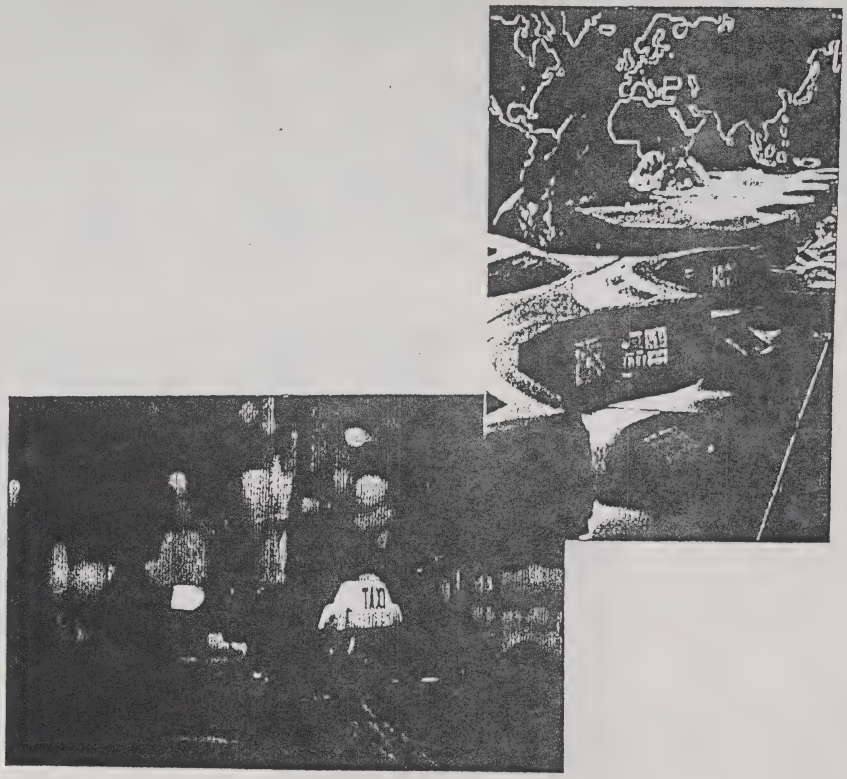
The only trans-Pacific private satellite operating NOW

TRW Space & Electronics Group is a world leader in the design, development and manufacture of space and electronics systems. TRW has, since 1958, built over 180 spacecraft, including the Tracking and Data Relay Satellites, and is now serving the market with satellite services for international communications.



International Broadcast and Cable Service

Broadcast, cable and other programmers can cost-effectively distribute programs around the world using TRW international satellite communications services. Space segment services are offered full-time or part-time for network or corporate analog and digital transmissions. Users on an Atlantic transponder can transmit programs in either direction between Europe and the U.S., or simultaneously downlink from both regions. Users on any Pacific transponder can transmit signals between the U.S. and the Far East in either direction, or simultaneously downlink programs both domestically and overseas.



Digital Video

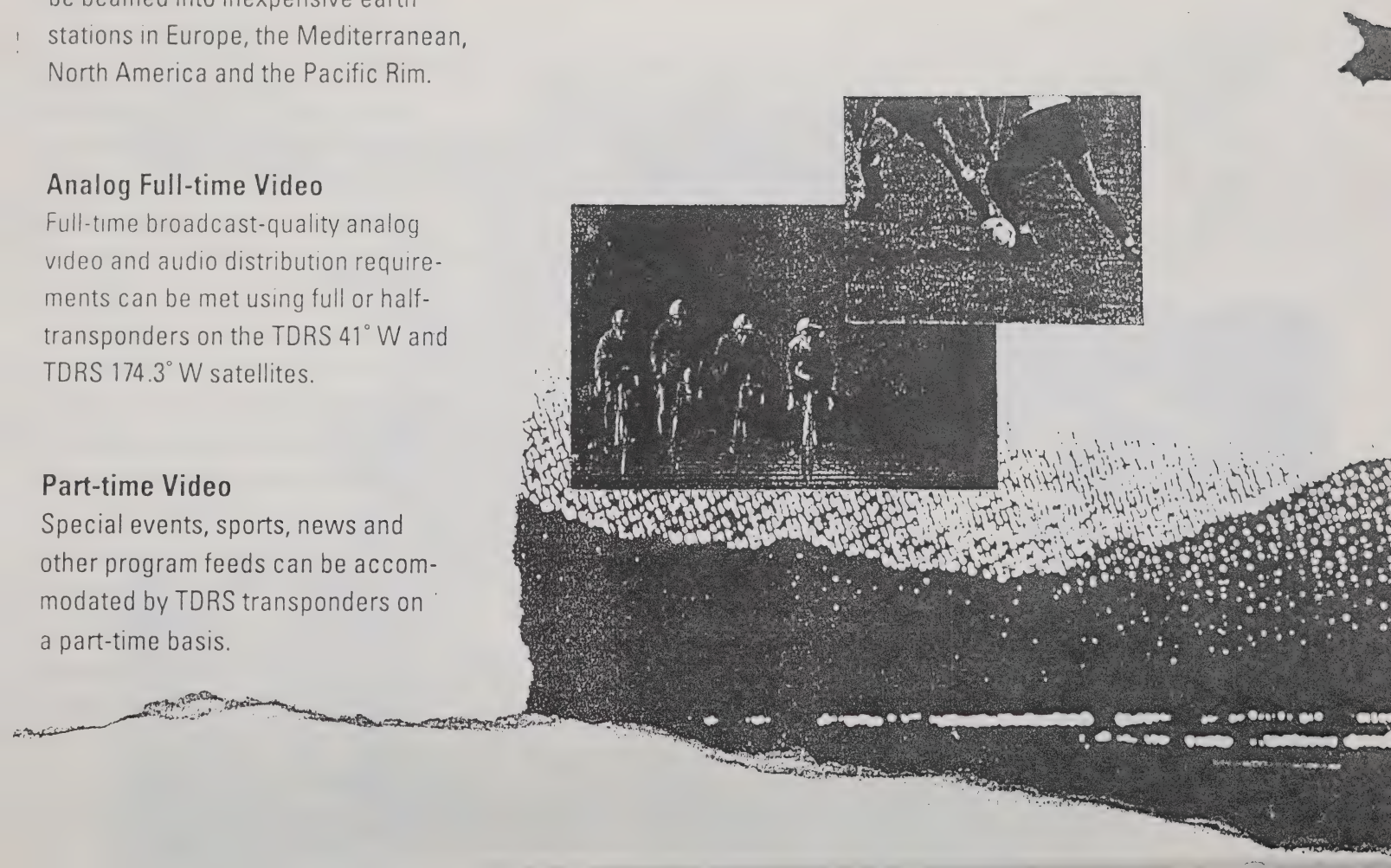
Broadcast, head-end or direct-to-home quality digital video signals can be beamed into inexpensive earth stations in Europe, the Mediterranean, North America and the Pacific Rim.

Analog Full-time Video

Full-time broadcast-quality analog video and audio distribution requirements can be met using full or half-transponders on the TDRS 41° W and TDRS 174.3° W satellites.

Part-time Video

Special events, sports, news and other program feeds can be accommodated by TDRS transponders on a part-time basis.



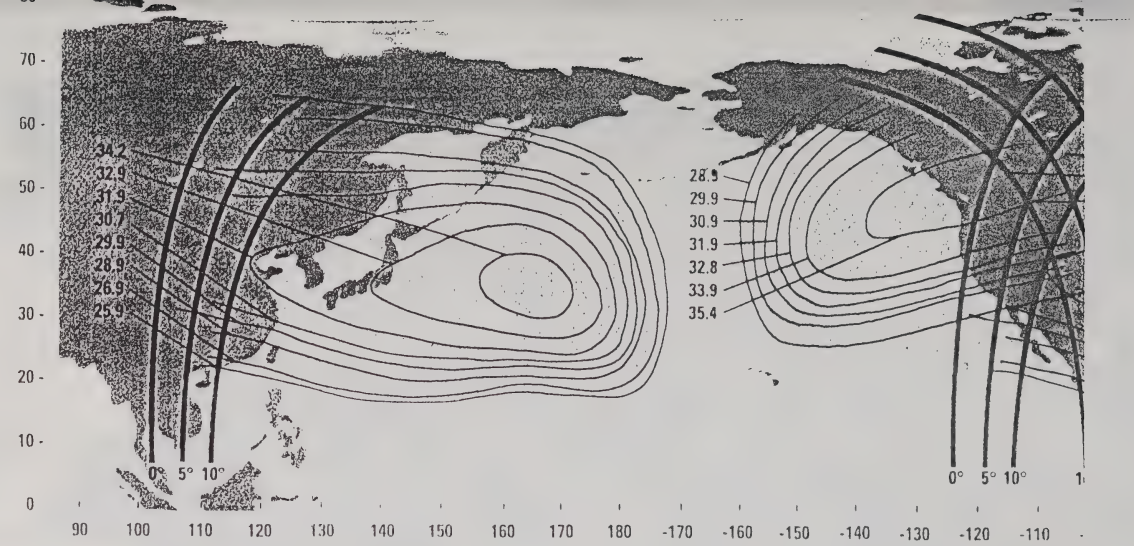
C-Band

Downlink,

Maximum

EIRP

36.2 dBW



TDRSS

Pacific

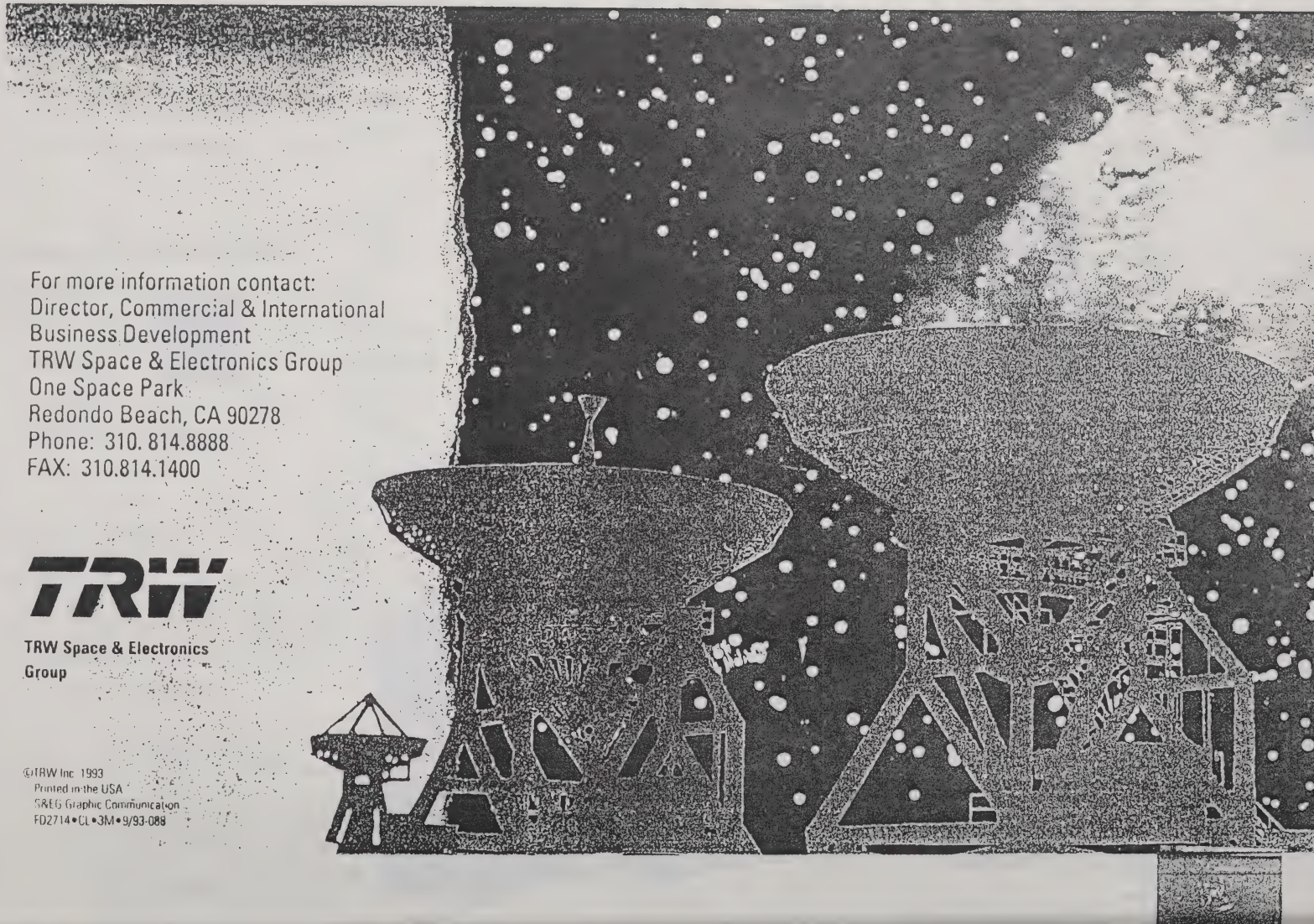
Performance

174.3°

West

Longitude

Key City	Elevation Angle Degrees	EIRP dBW	G/T dB/°K	SFD dBW/m²	Key City	Elevation Angle Degrees	EIRP dBW	G/T dB/°K	SFD dBW/m²
Albuquerque	9.4	28.9	-7.9	-81.2	Beijing	6.8	31.5	-6.9	-82.2
Anchorage	17.9	29.5	-17.7	-71.4	Guam	40.1	23.0	-15.0	-74.1
Boise	14.2	33.9	-3.4	-85.7	Guangzhou(Canton)	7.1	26.3	-11.9	-77.2
Denver	7.5	30.9	-5.4	-83.7	Hong Kong	8.1	26.3	-12.9	-76.2
Honolulu	58.8	23.0	-16.7	-72.4	Manila	15.4	23.0	-16.7	-72.4
Las Vegas	16.1	30.4	-5.2	-83.9	Okinawa	20.2	30.2	-6.9	-82.2
Los Angeles	19.5	29.6	-6.9	-82.2	Pyongyang	14.0	31.0	-5.9	-83.2
Phoenix	14.5	29.4	-8.9	-80.2	Sakhalin Island	19.7	30.7	-9.1	-80.0
Portland	17.5	35.2	-2.7	-86.4	Seoul	15.5	32.1	-5.9	-83.2
Salt Lake City	11.9	32.7	-4.5	-84.6	Shanghai	13.0	30.9	-6.9	-82.2
San Diego	19.0	29.5	-7.9	-81.2	Taipei	14.4	28.9	-9.9	-79.2
San Francisco	21.2	32.8	-4.4	-84.7	Tokyo	26.3	32.9	-5.9	-83.2
Seattle	16.3	35.4	-3.0	-86.1	Vladivostok	16.7	31.2	-6.4	-82.7
Vancouver	15.9	35.7	-3.6	-85.5					



For more information contact:
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Phone: 310. 814.8888
FAX: 310.814.1400

TRW

TRW Space & Electronics Group

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SATELLITE TV ASIA 93 - BASIC WORKSHOPS

SATELLITE TV & RADIO PROGRAMMING

I. SATELLITE COVERAGE AREAS

A. THE MIDDLE EAST
ASIASAT - ARABSAT 1C & 1D - INTELSAT (IOR)
STATSIONAR - ASTRA - EUTELSAT II

B. NORTHERN ASIA
ASIASAT - CHINASAT - INTELSAT (IOR & POR)
STATSIONAR - RIMSAT - TDRS-PACIFIC

C. SOUTHERN ASIA
ASIASAT - CHINASAT - PALAPA B - RIMSAT
INSAT II - INTELSAT (IOR & POR) - STATSIONAR

D. AUSTRALIA
OPTUS A/B - INTELSAT (POR & IOR FROM WEST COAST)
PALAPA B (NORTHERN COAST) - STATSIONAR

SATELLITE TV ASIA 93 - BASIC WORKSHOPS

SATELLITE TV & RADIO PROGRAMMING

E. NEW ZEALAND
INTELSAT (POR) - OPTUS B (LARGE DISHES)

F. PACIFIC ISLANDS
INTELSAT (GLOBAL BEAM SERVICES) - RIMSAT
PALAPA PACIFIC - TDRS PACIFIC (N. HEMISPHERE ONLY)

G. JAPAN AND NEARBY AREAS
BS-3A & 3B - JCSAT 1 & 2 - SUPERBIRD A & B

II. SERVICE CATEGORIES

A. NATIONAL TV SERVICES
THAILAND, MYANMAR, PAKISTAN, MALAYSIA, INDONESIA, CHINA, AUSTRALIA, PHILIPPINES, RUSSIA, AFGHANISTAN, VIETNAM, BRUNEI, JAPAN, MONGOLIA, INDIA, RFO FRANCE (TAHITI) KHAZIKSTAN TV, RADIO TV AZERBAIDJAN, THE U.S., AND VARIOUS MIDDLE EAST NATIONS.

SATELLITE TV ASIA 93 - BASIC WORKSHOPS

SATELLITE TV & RADIO SERVICES

B. INTERNATIONAL/REGIONAL CHANNELS (UNENCRYPTED)
AUSTRALIA TV INTERNATIONAL, CANAL FRANCE INTERNATIONAL, WORLDNET, C-SPAN, DEUTCHE WELLE, STAR TV, MTV ASIA, CNN INTERNATIONAL, BBC ASIA, PRIME SPORTS, ZTV, SUN TV, ASIA TV NETWORK, TV5 (FRANCE), RTP INTERNATIONAL (PORTUGAL) AND CCTV INTERNATIONAL (CHINA).

C. INTERNATIONAL CHANNELS (ENCRYPTED)
ESPN INTERNATIONAL, HBO ASIA, AND AFRTS TV,

D. DOMESTIC CABLE TV & SPECIALTY CHANNELS FOR JAPAN AND AUSTRALIA

E. SATELLITE NEWS GATHERING & DISTRIBUTION CHANNELS
VIS-ASIA, REUTERS TELEVISION, WORLD TELEVISION NEWS, NHK, FUJI TV, TV ASAHI, TV TOKYO, TOKYO BROADCSTING INTERNATIONAL (TBI), AND MANY OTHERS.

SATELLITE TV ASIA 93 - BASIC WORKSHOPS

SATELLITE TV & RADIO SERVICES

III. SATELLITE RADIO SERVICES

A. AUDIO SUBCARRIER SERVICES
BBC WORLD SERVICE, VOICE OF AMERICA, AFRTS RADIO, RADIO MOSCOW, REGIONAL CHINESE RADIO NETWORKS, CNN RADIO, RADIO HANOI, KHAZIKSTAN RADIO, RADIO KUWAIT, RADIO SUDAN, RADIO ORIENT, ABC AUSTRALIA.

B. SINGLE CHANNEL PER CARRIER (SCPC) SERVICES
RADIO THAILAND & MACQUARIE RADIO.

C. DIGITAL RADIO SERVICES
VARIOUS DOMESTIC NETWORKS IN JAPAN AND AUSTRALIA.

IV. MARKETING FOREIGN SATELLITE TV & RADIO PROGRAMMING
EDUCATIONAL INSTITUTIONS, EXPATRIATE COMMUNITIES, GOVERNMENT AGENCIES.

SATELLITE TV ASIA 93 - BASIC WORKSHOPS

SATELLITE TV & RADIO SERVICES

V. LEGALITY ISSUES

A. THE CURRENT SITUATION IN CHINA, BURMA, SINGAPORE, MALAYSIA, CAMBODIA, ETC.

B. DISCUSSION PERIOD FOR DELEGATES TO TALK ABOUT LEGAL RESTRICTIONS IN THEIR RESPECTIVE COUNTRIES AS WELL AS THE STATE OF TVRO IN GENERAL.

C. TOWARDS A FUTURE OPEN SKIES POLICY FOR THE ASIA/PACIFIC REGION.

1. EDUCATION OF GOVERNMENT OFFICIALS

2. COMBATTING THE CULTURAL IMPERIALISM ARGUMENT

3. DEMONSTRATIONS AND PROMOTIONS TO THE PUBLIC

TV & Radio Distribution Satellites (ITU Region 3)

○ = Ku-/Ka-band
● = C-band only
⊘ = C-/Ku-band
⊕ = UHF only
◍ = Ku-band only
○ = C-/S or C-/Ka

Intelsat 507 57° East
Intelsat 602 60° East
Intelsat 604 63° East
Intelsat 510 66° East
Insat 2A 74° East
Thaicom A1 78.5° East
Statsionar 13 80° E
Insat 1D (India) 82.9° E
Statsionar 6 (CIS) 90° E
Intelsat 501 91.5° East
Insat 2B (India) 93.5° East
Statsionar 14 (CIS) 96° E
DFH2-A3 (China) 98° East
Statsionar-21 (CIS) 103° East
Asiasat [China) 105.5° East
Palapa B2R (Indonesia) 108° East
BS-3A & **BS-3B** (Japan) 110° East
DFH2-A2 (PRC) 110.5° East
Palapa B2P (Indnsa.) 113° East
Chinasat-5 (China) 115.5° East
Palapa B4 (Indnsa.) 118° East
TongaStar (Tonga) 130° East
CS-3A (Japan) 132° East
Palapa Pacific (Indonesia) 134° East
CS-3B (Japan) 136° East
Statsionar 7 (CIS)140° East
JCSat 1 (Japan) 150° East
JCSat 2 (Japan) 154° East
Optus A2 (Australia) 156° East
Superbird A (Japan) 158° East
Optus B1 (Australia) 160° East
Superbird B (Japan) 162° East
Optus A3 (Australia) 164° East
Intelsat 701 174° East
Intelsat 511 177° East
Intelsat 508 180° East
Intelsat 503 183° East
TDRS-West [NASA] 185.7° East

INTERNATIONAL AND REGIONAL SATELLITES SERVING INTERNATIONAL TELECOMMUNICATION UNION (ITU) REGION 3

Sat.	Orbit	Tr.#	Beam	Pol/Freq	BW	Service/ Description	Audio Subcarrier	Beam Center EIRP
INTELSAT V & VA SATELLITES AT 183°, 180°, 177°, & 174° EAST								
I-503	183 E	71	ES	V-10.975	30	**TV Tokyo**	5.8/6.8 MHz	44 dBW
I-503	183 E	71	ES	V-11.015	30	**Nihon TV Net/Tokyo** (NBC News in off-hours)	5.8/6.8 MHz	44 dBW
I-503	183 E	79	ES	V-11.510	30	**TV Asahi** (CNN domestic encrypted in off-hours)	6.8 MHz	44 dBW
I-508	180 E	11[1]	WH	RH-3.720	27	**ESPN Int.**—U.S. [Encrypted—B-MAC]	B-MAC	29 dBW
I-508	180 E	41[1]	NW/ Z	LH-3.725	36	**CNBC**—U.S. (Feed to Wharf Cable in Hong Kong)	6.6 MHz	29 dBW
I-508	180 E	11[3]	WH	RH-3.765	36	**LA to Network 10 Aust. & TV3 New Zealand** Including CNN, CNBC & NHK's "Japan Today"	6.6 MHz	28 dBW
I-508	180 E	42[7]	WH	LH-3.840	36	**Occasional Video** K2 SKYLINK [KDD/Keystone]	6.65 MHz	29 dBW
I-508	180 E	12[7]	WH	RH-3.845	36	**CNN International** CNN Headline News	6.65 MHz 6.3 MHz	29 dBW
I-508	180 E	13[09]	WH	RH-3.875	20	**NBC/CNBC to Ch. 7 Aust.** Vidiplex Frame A: NBC Vidiplex Frame B: CNBC	5.58 MHz 5.73 MHz	26 dBW
I-508	180 E	13[10]	WH	RH-3.895	20	**Occasional Video** CNBC, CNN, BBC, etc. to ABC Australia	5.76/6.6 MHz	26 dBW
I-508	180 E	13[12]	WH	RH-3.930	20	**LA to Channel 9 Aust.** Vidiplex Frame A: ABC Vidiplex Frame B: CBS Radio Service: Auxiliary 1: Auxiliary 2:	6.65 MHz 6.12 MHz 6.30 MHz 5.6025 MHz 5.7375 MHz 5.4175 MHz	26 dBW

Sat.	Orbit	Tr.#	Beam	Pol/Freq	BW	Service/ Description	Audio Subcarrier	Beam Center EIRP
I-508	180 E	14[14]	WH	RH-3.975	36	**Worldnet/CSPAN/**	6.65 MHz	29 dBW
						Deutsche Welle TV	6.65 MHz	
						Voice of America	7.02 MHz	
						VOA French & Spanish	7.20 MHz	
						VOA Vietnam & Tibet	7.35 MHz	
						VOA Laos, Korea	7.45 MHz	
						VOA Chinese	7.53 MHz	
						VOA English	7.60 MHz	
I-508	180 E	44[13]	G	RH-4.015	22	**NHK/TV Tokyo/ABC**	6.6/7.5 MHz	25 dBW
I-508	180 E	35[18]	G	RH-4.045	20	**RFO France TV** (for Tahiti in SECAM)	6.65 MHz	29 dBW
I-508	180 E	37[22]	G	RH-4.135	20	**Nine Network Aust.** [PAL]	6.65 MHz	25 dBW
I-508	180 E	38[23]	G	RH-4.167	20	**Occasional Video-** TVNZ-1 News feeds	6.65 MHz	22 dBW
I-508	180 E	38[24]	G	RH-4.188	20	**Occasional Video-** TVNZ-2 News and Sports Feeds including BBC/Sky/ WTN News to the Pacific	6.65 MHz	22 dBW
I-508	180 E	79	ES	V-11.480	30	**TBS** (CBS/EBN/off hours) [Tokyo Broadcasting System]	5.8/6.8 MHz	44 dBW
I-508	180 E	79	ES	V-11.510	30	**Fuji TV** (ABC/off hours)	5.8/6.8 MHz	44 dBW
I-511	177 E	38[23]	G	RH-4.166	20	**Occasional Video** Fuji TV, etc.	6.6 MHz	25 dBW
I-511	177 E	88[22]	G	LH-4.177	27	**AFRTS-Pacific** [Encrypted—B-MAC] Auxiliary services: AFRTS Radio	B-MAC 7.4 MHz	25 dBW
I-511	177 E	38[24]	G	RH-4.187	20	**Occasional Video** TTV Taiwan, etc.	6.65 MHz	25 dBW
I-701	174 E	38[23]	G	RH-4.166	20	**Occasional Video-**	6.6/6.65 MHz	23 dBW
		38[24]		RH-4.187	20	RFO feeds, TVBS Taiwan to Hong Kong, etc.		

Sat.	Orbit	Tr.#	Beam	Pol/Freq	BW	Service/ Description	Audio Subcarrier	Beam Center EIRP
OPTUS A2 (AUSTRALIA) - 164° EAST								
Optus A2 has been placed into an inclined orbit to extend its operational lifetime. At the time of writing, the satellite was carrying only voice and data traffic on behalf of Optus Communications.								
SUPERBIRD B & SUPERBIRD A (SCC—JAPAN) - 162° & 158° EAST								
SCC-B	162 E	—	S	H-12.210	27	**Color Bars**	PCM	53 dBW
SCC-B	162 E	11	S	H-12.390	27	**Universal One TV** [Moonies Religious]	PCM	53 dBW
SCC-B	162 E	02	S	V-12.410	27	**Cable Soft Network** [SKYPORT Encrypted]	PCM	53 dBW
SCC-B	162 E	12	S	H-12.430	27	**Sky Ace Channel** [Chinese language]	PCM	53 dBW
						Medical Vision [Encrypted—Skyport System]	Sundays only	
SCC-B	162 E	03	S	V-12.450	27	**Super Channel** [Skyport Encrypted]	PCM	53 dBW
						Weather Channel	PCM—Audio Only	
SCC-B	162 E	04	S	V-12.490	27	**Nihon Cable TV Net.** [Encrypted—Skyport System]	PCM	53 dBW
SCC-B	162 E	05	S	V-12.530	27	**Life Design Channel** [Skyport Encrypted]	PCM	53 dBW
SCC-B	162 E	15	S	H-12.550	27	**Kids Station/ Omnibus Channel**	PCM	53 dBW
SCC-B	162 E	06	S	V-12.570	27	**Space Vision Netork** [Skyport Encrypted]	PCM	53 dBW
SCC-B	162 E	07	S	V-12.610	27	**Asahi New Star**	PCM	53 dBW
SCC-B	162 E	08	S	V-12.650	27	**Japan Cable Television** [CNN Relay/Encrypted—Skyport System]	PCM	53 dBW
SCC-B	162 E	09	S	V-12.690	27	**Music Channel** [MTV Japan/Encrypted—Skyport System]	PCM	53 dBW
SCC-B	162 E	10	S	V-12.730	27	**Star Channel** [Encrypted—Skyport System]	PCM	53 dBW

Sat.	Orbit	Tr.#	Beam	Pol/Freq	BW	Service/ Description	Audio Subcarrier	Beam Center EIRP
SCC-A	158 E	02-A	S	H-12.300	27	**Tokyo Broadcasting System (TBS)** – SNG Channel	5.75/6.2 MHz	47 dBW
SCC-A	158 E	02-B	S	H-12.320	27	**Tokyo Broadcasting System (TBS)** – SNG Channel	5.75/6.2 MHz	47 dBW
SCC-A	158 E	03	S	H-12.350	27	**Nihon TV Network** – SNG Channel	5.75/6.2 MHz	47 dBW
SCC-A	158 E	05-A	S	H-12.380	27	**Fuji TV Network**	5.8/6.2 MHz	47 dBW
SCC-A	158 E	05-B	S	H-12.400	27	**Fuji TV Network**	5.8/6.2 MHz	47 dBW
SCC-A	158 E	6	S	H-12.520	27	**TV Tepco** (Tokyo Electric Power Co. Ltd.)	5.75/6.2 MHz	47 dBW
SCC-A	158 E	13	S	V-12.570	27	**Color Bars**	6.2 MHz	47 dBW
OPTUS B1 & A3 (AUSTRALIA) - 160° & 156° EAST								
B1	160 E	01	N/SE	V-12.277	54	**Data (inc. Arnsat)** (Aust. Radio Network Satellite)		49 dBW
B1	160 E	03-L	NB	V-12.389	36	**Network News Feeds** [PAL/NTSC]		42 dBW
B1	160 E	03-U	NB	V-12.421	36	**7 Network (SPS)** [Encrypted – E-PAL/VAMP] Order wire channels: [Wegener]	7.38/7.56 MHz	42 dBW
B1	160 E	04-L	NB	V-12.453	27	**Network 10 Int.** Interchange News/Promo	7.38/7.56 MHz	38 dBW
B1	160 E	04-U	NB	V-12.485	27	**Network 10** [Encrypted – E-PAL]	7.38/7.56 MHz	38 dBW
B1	160 E	05	SE	V-12.533	27	**SBS – Specialized Broadcast Service** [Encrypted – B-MAC] Radio 2EO (Sydney) Radio 3EO (Melbourne) MAC-Text: reception hints	B-MAC Ethnic TV Programs	49 dBW
B1	160 E	06	NB	V-12.597	27	**Sky TV** [Encrypted – B-MAC] Omnicast Radio	B-MAC	49 dBW

Sat.	Orbit	Tr.#	Beam	Pol/Freq	BW	Service/ Description	Audio Subcarrier	Beam Center EIRP
B1	160 E	07	SE	V-12.661	27	**ABC HACBSS** [Encrypted—B-MAC] DBS TV Service Auxiliary Services: ABC National Radio ABC Regional Radio ABC Teletext	B-MAC with Stereo audio	49 dBW
B1	160 E	08	N/SE	V-12.725	27 36	**Sky Special Event/** **9 Network** [PAL/NTSC]	B-MAC 7.38/7.56 MHz	49 dBW
B1	160 E	09	NB	H-12.309	54	**Data Services**		
B1	160 E	10	NB	H-12.373	43	**Rural Doctor's Satellite Network** [PAL]	7.38/7.56	45 dBW
B1	160 E	11	NE	H-12.436	36	**TV Oceaniana [Japanese Tourist Channel]**	Videocrypt	49 dBW
B1	160 E	13-L	NB	H-12.548	27	**ABC TV International**	B-MAC	38 dBW
B1	160 E	13-U	NB	H-12.581	27	**Data Services**		
B1	160 E	14	NE	H-12.629	27	**ABC TV - HACBSS** [Encrypted—B-MAC] Queensland DBS Service Auxiliary Services: ABC National & Regional Radio Services ABC Teletext	B-MAC (Stereo)	49 dBW
B1	160 E	15	NE	H-12.693	27	**RCTS: QSTV** [Queensland Satellite TV] [Encrypted—B-MAC] Regional DBS TV Service Auxiliary services: MAC-Text TV Guide	B-MAC (Stereo)	49 dBW
A3	156 E	01	NA	V-12.277	36	**Occasional Video-** [CSIRO/OPTUS: PAL—Clear]	6.6/6.65 MHz	38 dBW
A3	156 E	02	WA	V-12.341	27	**Golden West Network** [Encrypted—B-MAC] Regional DBS TV Service Auxiliary Services: Perth Rock Radio Teletext: TV Guide	B-MAC with Stereo audio 96 FM Stereo	50 dBW
A3	156 E	03	NA	V-12.405	36	**Voice & Data Services**/Department of Defense		
A3	156 E	04	NA	V-12.469	43	**Data Services**		

Sat.	Orbit	Tr.#	Beam	Pol/Freq	BW	Service/ Description	Audio Subcarrier	Beam Center EIRP
A3	156 E	05	SE	V-12.533	36	**Occasional Video Enterprise Channel**	B-MAC	44 dBW
A3	156 E	06	NA	V-12.597	43	**Data Services**		
A3	156 E	07	WA	V-12.661	27	**Enterprise Channel/ TV Oceaniana**	B-MAC [PAL]	50 dBW
A3	156 E	08	WA	V-12.725	27	**ABC HACBSS** [Encrypted—B-MAC] DBS TV Service Auxiliary Services: ABC National & Regional Radio Services ABC Teletext	B-MAC with Stereo audio	50 dBW
A3	156 E	09	NB	H-12.309	43	**Department of Aviation (3)** Data Service		
A3	156 E	10	NB	H-12.373	43	**Department of Aviation (4)** Data Service		
A3	156 E	11	NE	H-12.436	27	**TV Oceaniana/ TSN 11**	Videocrypt B-MAC	50 dBW
A3	156 E	12	CA	H-12.501	27	**ABC HACBSS** [Encrypted—B-MAC] DBS TV Service Auxiliary Services: ABC National & Regional Radio Services ABC Teletext	B-MAC with Stereo audio	50 dBW
A3	156 E	13	NB	H-12.565	43	**Telecom 1/[ITERRA]** Audio & Data Services	SCPC	
A3	156 E	14	CA	H-12.629	27	**RCTS: Imparja—** ("Foot from the sky") [Encrypted—B-MAC] Aboriginal DBS TV Service Auxiliary Services: Aboriginal Radio MAC-Text: TV Guide	B-MAC with Stereo audio	50 dBW
A3	156 E	15	CA	H-12.693	27	**ABC HACBSS** [Encrypted—B-MAC] DBS TV Service Auxiliary Services: ABC National & Regional Radio Services ABC Teletext	B-MAC with Stereo audio	50 dBW

Sat.	Orbit	Tr.#	Beam	Pol/Freq	BW	Service/ Description	Audio Subcarrier	Beam Center EIRP
JCSAT 2 & JCSAT 1 (JAPAN) - 154° & 150° EAST								
JCSat-2	154 E	02	S	H-12.283	27	**Japan Religious &**	PCM	53 dBW
						Japan Leisure Channel	6.2 MHz	
						Cable TV Access Ch.	PCM - Saturday only	
JCSat-2	154 E	03	S	V-12.298	27	**Business News Net.** [Encrypted – M System]	PCM Thursday only	53 dBW
JCSat-2	154 E	04	S	H-12.313	27	**Nikkei Satellite News**	PCM	53 dBW
JCSat-2	154 E	06	S	H-12.343	27	**High Tech Shower** [Encrypted – M System]	PCM	53 dBW
						Dental Channel	PCM - Saturday only	
						Diamond Channel	PCM (Preview Channel)	
JCSat-2	154 E	07	S	V-12.35825	27	**M-Channel (JMTV)** [Encrypted – M System]		
JCSat-2	154 E	08	S	V-12.388	27	**Channel NECO**	6.2 MHz	53 dBW
JCSat-2	154 E	10	S	H-12.403	27	**Rainbow Channel/**	PCM	53 dBW
						M-Channel (JMTV)	[Encrypted – M System]	
JCSat-2	154 E	13	S	V-12.448	27	**Midnight Blue** [Encrypted – M System]	PCM	53 dBW
JCSat-2	154 E	16	S	H-12.493	27	**Satellite Culture Japan**	PCM	53 dBW
JCSat-2	154 E	18	S	H-12.523	27	**Space Shower TV** [COATEC Encrypted]	PCM	53 dBW
JCSat-2	154 E	19	S	V-12.538	27	**Keirin Channel**	PCM	53 dBW
JCSat-2	154 E	22	S	H-12.583	27	**Japan Sports Channel** [COATEC Encrypted]	PCM	53 dBW
JCSat-2	154 E	23	S	V-12.598	27	**PCM Zipang**	PCM	53 dBW
						Radio Sky – Audio	PCM-COATEC Encrypt	
JCSat-2	154 E	24	S	H-12.613	27	**Satellite Theater**	PCM	53 dBW
JCSat-2	154 E	25	S	V-12.628	27	**Music Bird** – Audio	PCM	53 dBW
						Satellite Music – Audio	PCM-COATEC Encrypt	
JCSat-2	154 E	26	S	H-12.643	27	**Satellite ABC**	PCM	53 dBW
JCSat-2	154 E	29	S	V-12.688	27	**Color Bars**	PCM	53 dBW

Sat.	Orbit	Tr.#	Beam	Pol/Freq	BW	Service/ Description	Audio Subcarrier	Beam Center EIRP
JCSat-1	150 E	02	S	H-12.283	27	**Occasional Video** News SNG – TV Asahi	6.2 MHz	53 dBW
JCSat-1	150 E	08	S	H-12.373	27	**NHK-SNG**	PCM	53 dBW
JCSat-1	150 E	10	S	H-12.403	27	**NHK-SNG**	PCM	53 dBW
JCSat-1	150 E	15	S	V-12.463	27	**P-SAT (MPT-Japan) & Japan Mercantile TV** [Encrypted – M System]	PCM	53 dBW
JCSat-1	150 E	27	S	V-12.658	27	**Color Bars**	PCM	53 dBW
				STATSIONAR 16 & 7 (C.I.S.) - 145 & 140° EAST				
Stat. 16 [Russia]	145 E	10[9]	G	RH-3.875	36	**Dub'l 1** Radio Russia	7.5MHz 7.0 MHz	29 dBW
Stat. 7 [Russia]	140 E	6[-1]	S	RH-3.675	36	**Orbita I** Radio Mayak	7.0 MHz 7.5 MHz	44 dBW
				PALAPA PACIFIC (INDONESIA) - 134° EAST				
P Pac.	134 E	20	S	V-4.100		**Goldsun Satellite TV** **One Leader Music**	Digitally Compressed Digitally Compressed	
				RIMSAT - [TONGA] 130° EAST				
R1	130 E	-1	S	RH-3.675	36	**Sun TV** [Tamil language service in PAL]	6.6 MHz	44 dBW
				CHINASAT-5 (CHINA) - 115.5° EAST				
C5	115.5 E	01[01]	S	H-3.760	36	**Zhejiang TV Station**	6.6 MHz	36 dBW
C5	115.5 E	03[05]	S	H-3.803	36	**CCTV-2**	6.6 MHz	36 dBW
C5	115.5 E	04[07]	S	H-3.843	36	**Xizang TV/** **(Tibet)** Chinese Radio Service Tibetan Radio Service	6.6 MHz 6.6 MHz 7.1 MHz 7.6 MHz	36 dBW
C5	115.5 E	05[09]	S	H-3.883	36	**CCTV-1**	6.6 MHz	36 dBW
C5	115.5 E	07[13]	S	H-3.960	36	**Sichuang TV** Sichuang Radio	6.6 MHz 7.5 MHz	36 dBW

Sat.	Orbit	Tr.#	Beam	Pol/Freq	BW	Service/ Description	Audio Subcarrier	Beam Center EIRP
C5	115.5 E	11[22]	S	H-4.120	36	**Xinjiang TV Station**	6.6 MHz	36 dBW
C5	115.5 E	12[24]	S	H-4.160	36	**Guangzhou TV**	6.6 MHz	36 dBW
	PALAPA B4, B2P & B2R (INDONESIA) - 118°, 113° & 108° EAST							
P-B4	118 E	6[3V]	S	V-3810	20	**BBTV Thailand-Ch. 7**	6.6 MHz	30 dBW
P-B4	118 E	14[8V]	S	V-3.890	30	**EM-TV** (PNG)	5.9 MHz	36 dBW
P-B4	118 E	14[8V]	S	V-3.980	30	**Army TV Thai.-Ch. 5**	6.6 MHz	36 dBW
P-B2P	113 E	1[1H]	S	H-3.720	30	**The Discovery Channel**	6.8 MHz	34 dBW
P-B2P	113 E	5[3H]	S	H-3.800	30	**RCT1 Indonesia** [Rajamari Citra Televisi]	6.6/7.2 MHz	34 dBW
P-B2P	113 E	6[3V]	S	V-3.820	30	**TV3** (System Televisyan Malaysia)	6.6 MHz	34 dBW
P-B2P	113 E	8[4V]	S	V-3.860	30	**Canal France Int.**	6.6 MHz	34 dBW
P-B2P	113 E	9[5H]	S	H-3.880	36	**ATVI Australia** Radio Australia	6.8 MHz 7.20 MHz	36 dBW
P-B2P	113 E	10[5V]	S	V-3.900	30	**TV1 Malaysia**	6.80 MHz	36 dBW
P-B2P	113 E	11[6H]	S	H-3.920	30	**Asia Business News**	6.80 MHz	36 dBW
P-B2P	113 E	12[6V]	S	V-3.930	30	**TV Thailand-Ch. 11**	6.80 MHz	36 dBW
P-B2P	113 E	13[7H]	S	H-3.960	30	**ABS/CBN** [Philippines]	6.80 MHz	36 dBW
P-B2P	113 E	14[7V]	S	V-3.980	27	**CNN International**	6.8 MHz	36 dBW
P-B2P	113 E	15[8H]	S	H-4.000	27	**HBO Asia** [Encrypted—B-MAC]	B-MAC	36 dBW
P-B2P	113 E	16[8V]	S	V-4.020	36	**AN-TEVE**-Indonesia	6.8 MHz	36 dBW
P-B2P	113 E	17[9H]	S	H-4.030	18	**GMA** - Philippines	6.8 MHz	30 dBW
P-B2P	113 E	17[9H]	S	H-4.050	18	**KBP People's Network** - Philippines	6.8 MHz	30 dBW
P-B2P	113 E	18[9V]	S	V-4.060 V-4.0566475 V-4.0566925	36	**SCPC**—Radio Thailand—7 carriers Channel 326 Channel 327	 315 kHz BW 315 kHz BW	

Sat.	Orbit	Tr.#	Beam	Pol/Freq	BW	Service/ Description	Audio Subcarrier	Beam Center EIRP
				V-4.0567375		Channel 328	315 kHz BW	
				V-4.0567825		Channel 329	315 kHz BW	
				V-4.0568275		Channel 330	315 kHz BW	
				V-4.0568725		Channel 331	315 kHz BW	
				V-4.0569175		Channel 332	315 kHz BW	
P-B2P	113 E	19[10H]	S	H-4.080	30	**TPI**-Indonesia [Televisi Pendidikan Indonesia]	6.8 MHz	36 dBW
P-B2P	113 E	20[10V]	S	V-4.100	27	**ESPN International** [Encrypted—B-MAC]	B-MAC	36 dBW
P-B2P	113 E	21[11H]	S	H-4.120	30	**SCTV**-Indonesia [Surya Citra Televisi]	6.6 MHz	36 dBW
P-B2P	113 E	22[11V]	S	V-4.140	30	**The Gold Network** [Nine Network Australia]	6.2/6.8 MHz	36 dBW
P-B2P	113 E	23[12H]	S	H-4.160		**TVB** [Hong Kong]	Digitally Compressed	
P-B2P	113 E	24[12V]	S	V-4.180	30	**Singapore Int. TV** **Radio TV Brunei** **RTM-Sabah**	6.8 MHz 6.8 MHz 6.8 MHz	36 dBW
P-B2R	108 E	15[8H]	S	H-4.000	30	**TVRI**-Indonesia [Televisi Republik Indonesia]	6.8 MHz	36 dBW
P-B2R	108 E	21[11V]	S	H-4.120	30	**Occ. Video**-Indonesia	6.8 MHz	36 dBW
	DFH-2 A1 (CHINA) - 110.5° EAST							
DFH-1	110.5 E	7/8	S	H-3.848	30	**CETV 1-China**	6.6 MHz	31 dBW
DFH-1	110.5 E	9/10	S	H-3.928	30	**CETV 2-China**	6.6 MHz	31 dBW
	BS-3A & BS-3B (JAPAN) - 110° EAST							
BS-3A	110.0 E	07	S	RH-11.842	27	**DBS-1 [Joho]**	PCM	55 dBW
BS-3A	110.0 E	11	S	RH-11.919	27	**DBS-2 [NHK]**	PCM	55 dBW
BS-3B	110.0 E	05	S	RH-11.804	27	**Japan Satellite Bct.** [Encrypted—COATEC System] St. Giga Audio Only	PCM PCM	52 dBW
BS-3B	110.0 E	09	S	RH-11.880	27	**Japan HDTV Tests**	PCM	52 dBW

Sat.	Orbit	Tr.#	Beam	Pol/Freq	BW	Service/ Description	Audio Subcarrier	Beam Center EIRP
	ASIASAT 1 (HONG KONG) - 105.5° EAST							
A1	105.5 E	2H[3]	NB	H-3.760	36	**Mongolia Television** Mongolia [SECAM] **Worldnet** [USIA]	6.6 MHz 6.6 MHz	37 dBW
A1	105.5 E	3H[5]	NB	H-3.800	36	**Prime Sports** [STAR TV - NTSC] Mandarin audio	5.58/5.76 MHz PANDA I stereo 5.94 MHz PANDA I mono	37 dBW
A1	105.5 E	4H[7]	NB	H-3.840	36	**STAR Music** [NTSC-M] [STAR TV - NTSC] BBC World Service Radio (1)	5.58/5.76 MHz PANDA I stereo 5.94 MHz PANDA I mono	37 dBW
A1	105.5 E	5H[9]	NB	H-3.880	36	**STAR Movies** [STAR TV - NTSC] Mandarin audio	5.58/5.76 MHz PANDA I stereo 5.94 MHz PANDA I mono	37 dBW
A1	105.5 E	6H[11]	NB	H-3.920	36	**Chinese Channel** [STAR TV - NTSC] Mandarin audio BBC World Service Radio (3)	5.58/5.76 MHz PANDA I stereo 6.20 MHz 5.94 MHz PANDA I mono	37 dBW
A1	105.5 E	7H[13]	NB	H-3.960	36	**STAR Plus** [STAR TV - NTSC] BBC World Service Radio (2)	5.58/5.76 MHz PANDA I stereo 5.94 MHz PANDA I mono	37 dBW
A1	105.5 E	9H[17]	NB	H-4.040	36	**Chinese Prov. TV** [Guizhou/Yunnan TV] Provincial Radio	6.6 MHz PAL-D 7.5 MHz	37 dBW
A1	105.5 E	11H[21]	NB	H-4.120	36	**CCTV 4** [MRFTV—China]	6.2 MHz NTSC	37 dBW
A1	105.5 E	4V[8]	SB	V-3.860	36	**Prime Sports** [STAR TV - PAL] Mandarin audio	6.3/6.48 MHz PANDA I stereo 7.2 MHz Panda I mono	38 dBW
A1	105.5 E	5V[10]	SB	V-3.900	36	**STAR Music** [STAR TV - PAL] BBC World Service Radio (1)	6.3/6.48 MHz PANDA I stereo 7.20 MHz PANDA I mono	38 dBW
A1	105.5 E	6V[12]	SB	V-3.940	36	**BBC Asia** [STAR TV - PAL] Mandarin audio (mono)	6.3/6.48 MHz PANDA I stereo 7.20 MHz PANDA I mono	38 dBW

Sat.	Orbit	Tr.#	Beam	Pol/Freq	BW	Service/ Description	Audio Subcarrier	Beam Center EIRP
A1	105.5 E	7V[14]	SB	V-3.980	36	**Zee TV** [STAR TV - PAL] Mandarin audio (mono) BBC World Service Radio (3)	6.3/6.48 MHz PANDA I stereo 6.80 MHz 7.20 MHz PANDA I mono	38 dBW
A1	105.5 E	8V[16]	SB	V-4.020	36	**STAR Plus** [STAR TV - PAL] BBC World Service Radio (2)	6.3/6.48 MHz PANDA I stereo 7.20 MHz PANDA I mono	38 dBW
A1	105.5 E	9V[18]	SB	V-4.060	36	**STAR TV-Chinese Ch.**	6.3/6.48 MHz	38 dBW
A1	105.5 E	10V[20]	SB	V-4.100	36	**Pakistan TV**	6.6 MHz	38 dBW
A1	105.5 E	11V[22]	SB	V-4.140	36	**Myanmar TV** [Burma] [Burma]	6.6 MHz NTSC	38 dBW
STATSIONAR 21, 14, T (C.I.S.) - 103°, 96° & 99° EAST								
Stat. 21	103.0 E	6 [-1]	G	RH-3.675	36	**Dub'l -IV** Moscow Radio	7.0 MHz 7.5 MHz	36 dBW
Stat. 21	103.0 E	7 [1]	NH	RH-3.725	36	**Muslim TV Ahmadiyya** Urdu audio English audio Arabic audio	 6.5 MHz 7.0 MHz 7.2 MHz	31 dBW
Stat. 21	103.0 E	10[9]	G	RH-3.875	36	**Jain Satellite TV**	7.5 MHz	29 dBW
Stat. T [Russia]	99 E	UHF	NH	RH-0.714	36	**I Programma** [Orbita 3]	7.5 MHz	55 dBW
Stat. T	99 E	UHF	NH	RH-0.756	36	**Asianet**	NA	55 dBW
Stat. 14 [Russia]	96.5 E	6[-1]	S	RH-3.675	36	**Orbita-II** Radio Mayak	7.0 MHz 7.5 MHz	31 dBW
Stat. 14 [Russia]	96.5 E	9[6]	NH	RH-3.825	36	**CCTV-4 (China)** [PAL - for Chinese abroad]	6.6 MHz	31 dBW
Stat. 14 [Russia]	96.5 E	10[9]	NH	RH-3.875	36	**Azerbaidjan TV/Radio**	7.5 MHz	31 dBW

Sat.	Orbit	Tr.#	Beam	Pol/Freq	BW	Service/ Description	Audio Subcarrier	Beam Center EIRP
INSAT II-B [INDIA] - 93° EAST								
Ins-2B	93.5 E	—	S	LH-2.615	30	**Doordarshan TV**	5.5 MHz	40 dBW
Ins-2B	93.5 E	[06]	S	V-3.828	30	**DD Business/News**	5.8 MHz	36 dBW
Ins-2B	93.5 E	[10]	S	V-3.909	30	**DD Sports**	5.8 MHz	36 dBW
Ins-2B	93.5 E	[13]	S	V-3.983	30	**DD Metro**	5.8 MHz	36 dBW
Ins-2B	93.5 E	[22]	S	V-4.145	30	**DD Music**	6.6 MHz	36 dBW
STATSIONAR 6 & 3 (C.I.S.) - 90° & 85° EAST								
Stat. 6	90 E	6 [-1]	S	RH-3.675	36	**Dub'l II** Radio Moscow	7.0 MHz 7.5 MHz	44 dBW
Stat. 6 [Russia]	90 E	10[9]	NH	RH-3.875	36	**Orbita-II** Radio Mayak	7.5 MHz 7.0 MHz	31 dBW
Stat. 6 [Russia]	90 E	11[11]	NH	RH-3.915	30	**Dub'l-I** Feed to Far East	7.5 MHz	26 dBW
Stat. 6 [Russia]	90 E	11[11]	NH	RH-3.942	30	**Orbita-I** Feed to Far East	7.0 MHz	26 dBW
INSAT 1-D (INDIA) - 82.9 EAST								
Ins-1D	82.9 E	S1	S	V-2.575 V-2.615	36 36	**Doordarshan India All Community TV**	5.5 MHz	42 dBW
Ins-1D	82.9 E	[23]	S	H-4.170	18	**Doordarshan TV** Hyderabad, India	5.5 MHz	30 dBW
Ins-1D	82.9 E	[24]	S	H-4.190	18	**Doordarshan TV**	5.5 MHz	30 dBW
STATSIONAR 13 (C.I.S.) - 80° EAST								
Stat. 13	80 E	6[-1]	S	RH-3.675	36	**Dub'l-III**	7.0 MHz	44 dBW
Stat. 13	80 E	10[9]	NH	RH-3.875	36	**THVN -Vietnam** Radio Hanoi	7.5 MHz 7.0 MHz	31 dBW

Sat.	Orbit	Tr.#	Beam	Pol/Freq	BW	Service/ Description	Audio Subcarrier	Beam Center EIRP
	THAICOM A1 - 78.5° EAST							
Thai	78.5 E	08	S	V-3.880	30	**Army TV** Channel 5	6.6 MHz	36 dBW
Thai	78.5 E	15	S	V-4.000	30	THVN - TV Vietnam	7.5 MHz	36 dBW
	INSAT 2-A (INDIA) - 74° EAST							
Ins-2A	74 E	[16]	S	H-4.000	36	**Occasional Video**	5.5/6.6 MHz	36 dBW
Ins-2A	74 E	[21]	S	H-4.115	36	**Doordarshan TV**	5.5 MHz	36 dBW
Ins-2A	74 E	[22]	S	H-4.150	18	**Doordarshan TV**	5.5 MHz	30 dBW
Ins-2A	74 E	[24]	S	H-4.175	18	**Doordarshan TV**	5.5 MHz	30 dBW
	INTELSAT 510, 604, 602, & 507 - 66°, 63°, 60°, & 57° EAST							
I-510	66 E	15[06]	EH	RH-3.980	20	**Canal France Int.**	5.8 MHz	30 dBW
I-510	66 E	38[24]	G	RH-4.166	30	**Worldnet** [U.S. in PAL] **Deutsche Welle** [Germany in PAL]	6.60 MHz	29 dBW
I-510	66 E	13[09]	Z	LH-4.016	20	**NHK**-Feeds to Japan	6.6 MHz	30 dBW
I-604	63 E	38[23] 38[24]	G G	RH-4.168 RH-4.188	20 20	**Occasional Video-** News and sports feeds	6.6 or 6.65 MHz	Varies
I-602	60 E	38[23] 38[24]	G	RH-4.168 RH-4.188	20	**Occasional Video-** News and sports feeds	6.6 or 6.65 MHz	Varies
I-507	57 E	51[2]	EZ	LH-3.735	30	**Ch 3 Bangkok, Thail.**	6.8 MHz	29 dBW
I-507	57 E	51[4]	EZ	LH-3.770	30	**Ch 9 Bangkok, Thail.**	6.8 MHz	29 dBW
I-507	57 E	53[10]	EZ	LH-3.900	30	**BBC** (to Hong Kong)	B-MAC	29 dBW
I-507	57 E	23[11]	EH	RH-3.921	30	**Occasional Video†**	6.6/6.65 MHz	29 dBW
I-507	57 E	54[13]	EZ	LH-3.995	30	**Occasional Video†**	6.6/6.65 MHz	29 dBW
I-507	57 E	24[15]	EH	RH-4.011	27	**Occasional Video†**	6.6/6.65 MHz	29 dBW
I-507	57 E	25[18]	EH	RH-4.055	30	**Occasional Video†**	6.6/6.65 MHz	29 dBW
I-507	57 E	38[23] 38[24]	G	RH-4.168 RH-4.188	20	**Occasional Video-** News and sports feeds	6.6 or 6.65 MHz	Varies

† INTELSAT-designated available occasional video transponders.

Sat.	Orbit	Tr.#	Beam	Pol/Freq	BW	Service/ Description	Audio Subcarrier	Beam Center EIRP
STATSIONAR 5 & 12 (C.I.S.) - 53° & 40° EAST								
Stat. 5 [Russia]	53 E	6[-1]	S	RH-3.675	36	**I Programma** [Orbita-IV Vostok] **& TV Afghanistan**	7.0 MHz	44 dBW
Stat. 5 [Russia]	53 E	K1]	S	RH-11.525	36	**Occasional Video**	7.0 MHz	31 dBW
Stat.12 [Russia]	40.0 E	6[-1]	G	RH-3.675	36	**II Programma** [Moscow]	7.5 MHz	32 dBW
						Moscow Radio	7.0 MHz	
Stat.12	40.0 E	7[1]	G	RH-3.725	36	**TV 5** [France]	6.65 MHz	30 dBW
Stat.12	40.0 E	9[6]	G	RH-3.875	36	**Channel SZTV**	7.0 MHz	30 dBW
Stat.12	40.0 E	10[9]	G	RH-3.925	36	**RTP International** [Portugal]	6.65 MHz	30 dBW
Stat. 12 [Russia]	40.0 E	K1]	S	RH-11.525	36	**Occasional Video**	7.0 MHz	31 dBW
ARABSAT I-C - 31° EAST								
Abs I-C	31.0 E	1A	Z	V-2.634	32	**MBC**	6.6 MHz	43 dBW
Abs I-C	31.0 E	4	Z	RH-3.771	0.5	**Radio Sudan**	SCPC	33 dBW
Abs I-C	31.0 E	5	Z	LH-3.811	32	**Canal Plus Int.** [Fr.]	6.6 MHz	33 dBW
Abs I-C	31.0 E	7	Z	RH-3.82975	32	**CNN International**	6.6 MHz	33 dBW
Abs I-C	31.0 E	8	Z	LH-3.835	0.3	**Radio Orient**	SCPC	33 dBW
Abs I-C	31.0 E	9	Z	RH-3.866	32	**Occ. Video - ABSU**	6.65 MHz	33 dBW
Abs I-C	31.0 E	14	Z	LH-395925	32	**Dubai TV [UAE]**	6.60 MHz	33 dBW
Abs I-C	31.0 E	15	Z	RH-3.97775	32	**Saudi 1** [Arabic]	6.65 MHz	33 dBW
Abs I-C	31.0 E	17	Z	RH-4.008	18	**RTM-1 Morocco TV**	6.65 MHz	33 dBW
Abs I-C	31.0 E	18	Z	LH-4.03325	32	**Abu Dhabi TV [UAE]**	6.60 MHz	33 dBW
Abs I-C	31.0 E	19	Z	RH-4.05175	32	**Saudi 2** [English]	6.65 MHz	31 dBW
Abs I-C	31.0 E	20	Z	LH-4.062	18	**Oman TV**	6.60 MHz	31 dBW
Abs I-C	31.0 E	21	Z	RH-4.081	32	**TV Mauritania**	6.60 MHz	36 dBW
Abs I-C	31.0 E	22	Z	LH-4.10725	32	**MBC**	6.60 MHz	36 dBW
Abs I-C	31.0 E	23	Z	RH-4.12575	32	**Arab League TV**	6.60 MHz	33 dBW
Abs I-C	31.0 E	24	Z	LH-4.144	32	**JRT TV Jordan**	6.60 MHz	33 dBW
Abs I-C	31.0 E	25	Z	RH-4.16275	32	**TV Egypt**	6.60 MHz	33 dBW
Abs I-C	31.0 E	26	Z	LH-4.181	32	**KSC Kuwait**	6.60 MHz	33 dBW
						Radio Kuwait	5.8 MHz	

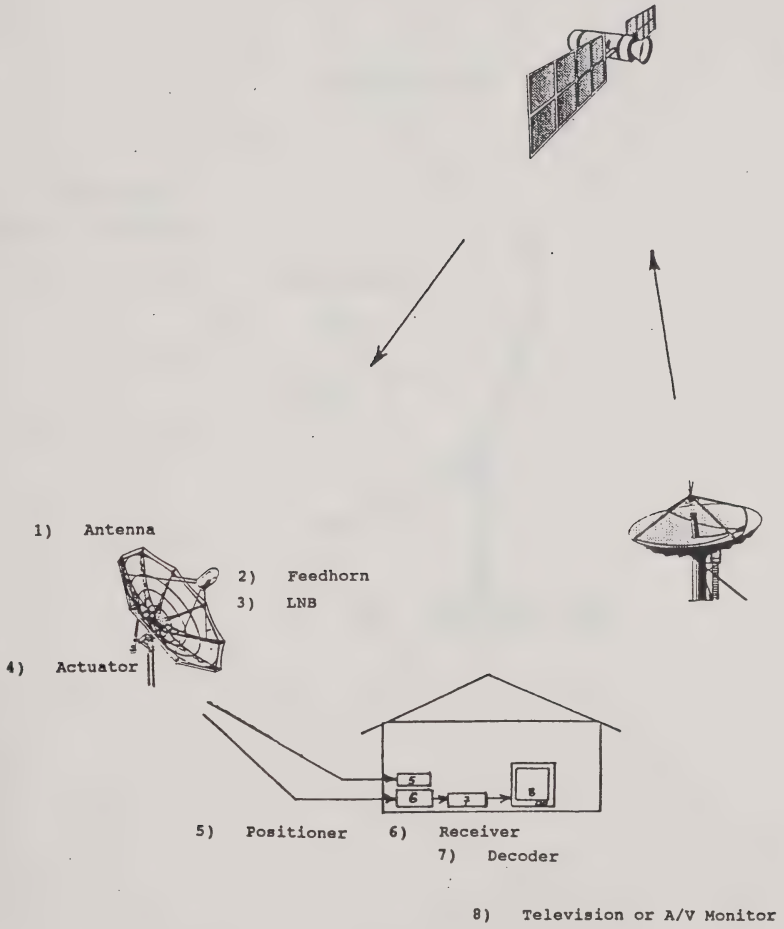
1993 Home Satellite TV Asia Conference
27 October 1993

BASIC WORKSHOP SESSION #2: THE GROUND SEGMENT
An Overview of Basic Satellite TV Receiving Components

presented by
Michael Davis
Echosphere Corp., Asian Division

Basic Components of a Home TVRO System

1)	Antenna	5)	Positioner
2)	Feedhorn	6)	Receiver
3)	LNB	7)	Decoder
4)	Actuator	8)	Television or A/V Monitor

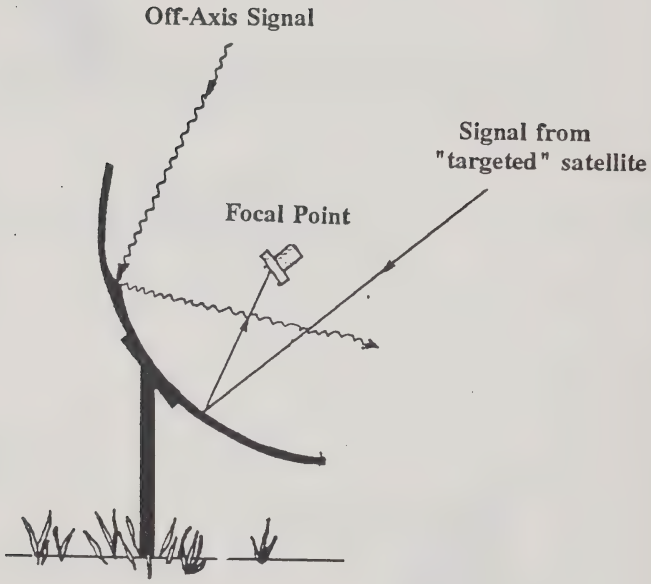


Antennas:

A TVRO antenna is a parabolic reflector of microwave signals.

Incoming C- or Ku-band signals are reflected from the surface of the antenna to the focal point.

Off-axis microwave signals are reflected away from the focal point.



Important Considerations for Selecting an Antenna:

* Geometric Design
  > slight imperfections in reflector shape may have dramatic affects (signal loss) on microwave signals

* Size
  > larger antennas are required to receive weak signals
  > smaller antennas can be used in strong signals areas, or for reception of high-frequency (Ku-band) signals

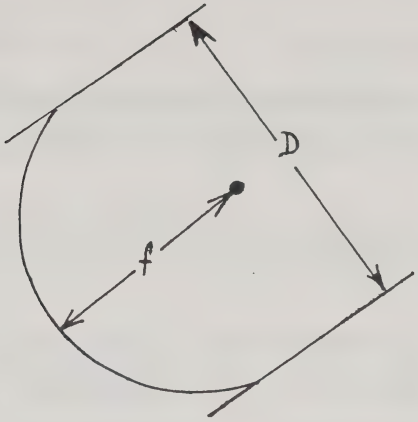
* Design/Manufacturing Quality
  > rib design
  > wind loading
  > powder coating

* Type of antenna
  > perforated aluminum
  > expanded aluminum (mesh)
  > solid aluminum
  > fiberglass

* Installation/Shipping Considerations
  > "quad" design vs. "sectional"

* Depth

  > "deep dishes" (f/D ratio less than 0.3) will reduce effects of terrestrial interference



* Mounts:

  > fixed

  > polar

  > az-el

  > Horizon to Horizon

  > equatorial adjustment

Feedhorns:

* The feedhorn is located at the focal point of the antenna.

* The feed collects the microwave signal, and provides a waveguide for the signal to pass to the LNB.

Signal Polarization

> Transmitted signals contain electronic and magnetic components oriented orthogonally (perpendicular) to each other.

> The signal from the satellite can be linear polarization or circular polarization.

> The polarizer probe at the end of the feedhorn "boresight" collects the incoming signal that is parallel to the probe. When the probe is oriented in one direction, the electric field in that direction will enter the waveguide. If the probe is rotated 90 degrees, the probe will allow the opposite polarity to enter the waveguide. The probe transfers the signal to the waveguide portion of the feedhorn. (A pulse width modulated signal from the satellite receiver controls the rotation of the mechanical probe.)

> Some feeds use a solid-state (not mechanical) ferrite device to select between horizontal and vertical polarities. Electric current from the satellite receiver changes the polarity "field" of the ferrite material.

> LNBFs use 13/18V switching from the satellite receiver to select between horizontal and vertical polarities. (Mechanical servo polarizer is not required.)

> C-band and Ku-band frequencies require different types of feeds (different sizes of waveguides).

LNBs:

* The LNB (Low Noise Block downconverter) amplifies the microwave signal that it receives via the feedhorn's waveguide.

* After amplification, the LNB "downconverts" the high frequency microwave signal to a lower frequency RF signal.

  > C-band downlink is 3.7 - 4.2 GHz

  > Ku-band downlink is typically 10.95 - 12.75 GHz

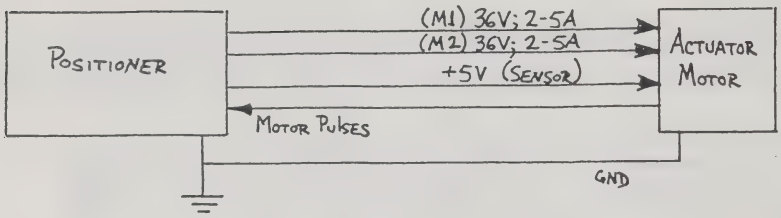
  > "Downconverted" LNB output is typically 950 - 2050 MHz

* The noise temperature rating of the LNB indicates the quality of signal amplification. Good LNB noise figures for a 25 degree LNB would look like:

Frequency (MHz)	Noise Temperature (degrees K)	Gain (dB)
3700	24	65.0
3800	23	66.6
3900	21	66.7
4000	21	66.8
4100	23	66.7
4200	24	66.3

* Actuated systems require a polar mount to accurately track the satellite "arc" above the earth's equator.

* Actuator operation:



* Linear actuators typically use either acme or ball screwjacks.

* The actuator motor must provide accurate pulses to indicate how many times the rotor turns. Motor pulses may be counted using either Reed Switch or "Hall Effect" sensors.

* The positioner must count the motor pulses, then determine how far the actuator has moved.

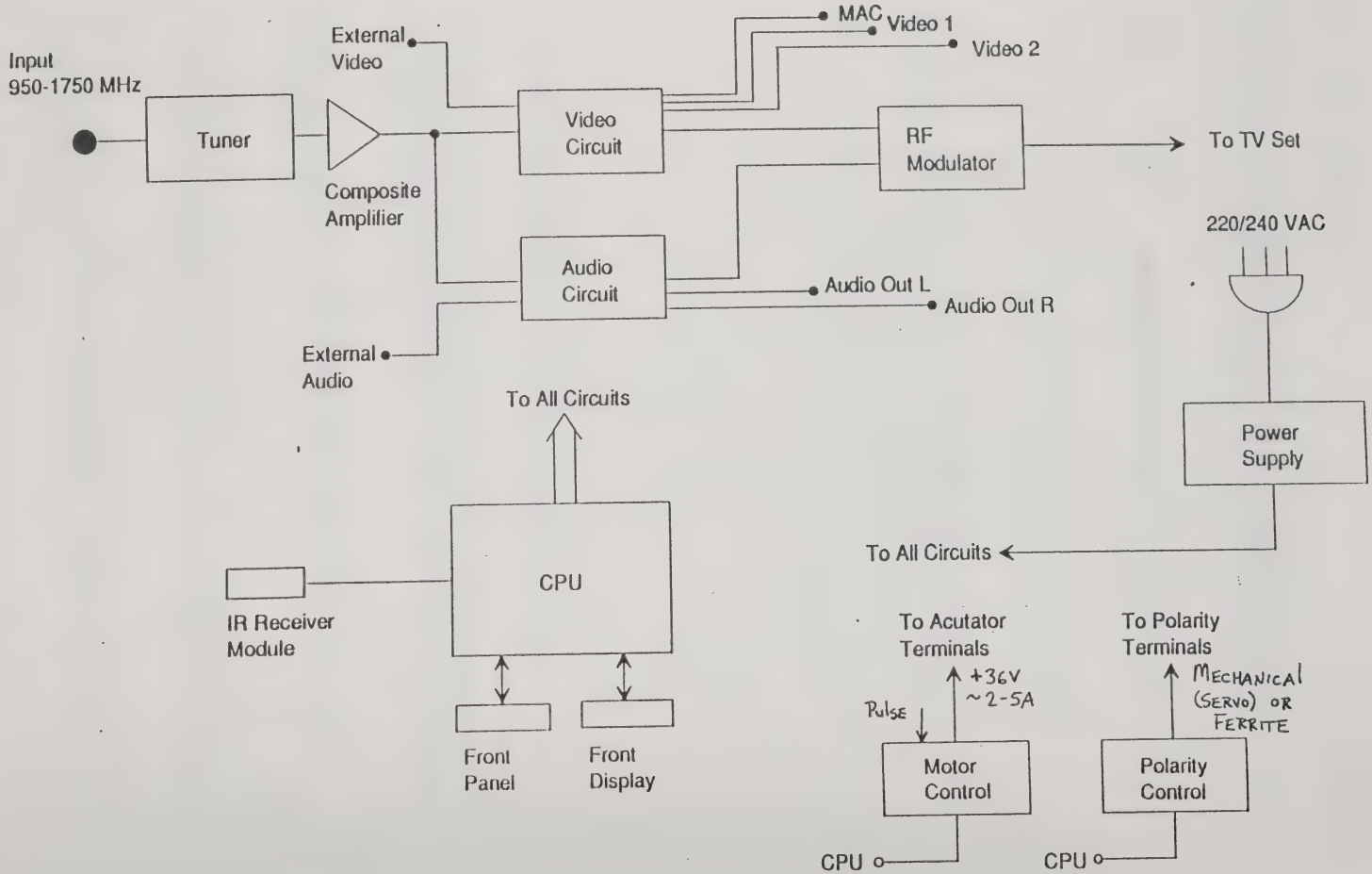
* The positioner should have the capability to "store" multiple positions in memory so that the antenna can repeatedly be moved to the same position.

* Horizon-to-Horizon actuators are gear-driven, and allow the antenna to be aimed at satellites on the east and west horizons. (Linear actuators have a limited movement.)

Satellite Receivers:

* The satellite receiver takes the RF output from the LNB and converts the signal to either modulated signal for the TV, or a composite video, and audio outputs for A/V monitor.

* Block diagram of a typical satellite receiver:


Input
950-1750 MHz
Tuner
External
Video
Composite
Amplifier
Video
Circuit
MAC
Video 1
Video 2
RF
Modulator
To TV Set
Audio
Circuit
Audio Out L
Audio Out R
External
Audio
220/240 VAC
Power
Supply
To All Circuits
To All Circuits
CPU
IR Receiver
Module
Front
Panel
Front
Display
To Acutator
Terminals
+36V
~2-5A
Pulse
Motor
Control
CPU
To Polarity
Terminals
MECHANICAL
(SERVO) OR
FERRITE
Polarity
Control
CPU

* Important (technical) factors for selecting a satellite receiver.

1) Audio and video quality

2) Actuator control (if required)

3) Polarization control (servo output and skew settings)

4) Software features

   > pre-programmed frequencies to assist installation

   > freely tunable frequencies

   > compatibility with decoders

5) Reliability

   > design quality
   (highly integrated vs. discrete circuit designs)

   > manufacturing quality

* If a broadcaster "scrambles" the uplink signal, a decoder is required at the downlink.

* The decoder can be a stand-alone unit, or can be a module of the satellite receiver (Integrated Receiver/Decoder = "IRD")

* Typical scrambling systems are:

>	VideoCipher	widely used in the U.S.
>	VideoCrypt	widely used in the U.K.
>	D2Mac	used primarily in Scandinavia
>	BMac	used globally, typically in commericial or cable applications

* Most (but not all) scrambling technologies are "open systems."

  > Multiple manufacturers can design or license compatible receivers to operate with decoders.

  > Most encoding/decoding circuits are proprietary.

* Most scrambling systems include a provision for "conditional access."

  > Conditional access systems allow the programmer to limit viewership to only authorized subscribers.

  > Typical conditional access systems include a method of receiving payment for programming by use of monthly subscriptions, "smart cards," or impulse "pay-per-view."

* Most Asian countries use the PAL standard for off-air transmissions.

  > Non-PAL countries in Asia are limited to Japan, Taiwan, the Philippines, and Korea

  > Most TVs in Asia are either PAL or "multi-standard."

* The northern beam of Asiasat is transmitted in the NTSC format. A typical viewer watching the northern beam of Asiasat would require one of the following system configurations:

  1) Satellite receiver with NTSC de-emphasis, A/V outputs (not modulated), to either multi-standard TV or VCR.

  2) Satellite receiver with PAL modulator output to PAL TV. (Loss of color, but picture is watchable.)

  3) (System Converter) Satellite receiver A/V outputs to NTSC-PAL chroma-converter; chroma-converter output to either:

     > PAL modulator connected to PAL television

     -- or --

     > PAL-only A/V monitor

SATELLITE TV ASIA 93 - PLENARY SESSION I

FUTURE ASIA/PACIFIC SATELLITE SYSTEMS

I. INTERNATIONAL SATELLITE SYSTEMS

A. INTELSAT - INDIAN & PACIFIC OCEAN REGIONS
B. PANAMSAT - INDIAN & PACIFIC OCEAN REGION
C. UNICOM - INDIAN & PACIFIC OCEAN REGIONS

II. REGIONAL SATELLITE SYSTEMS

A. ASIASAT-2
B. APSTAR 2
C. PALAPA C
D. ARABSAT II -
E. PACIFICOM (TRW)

III. DOMESTIC SATELLITE SYSTEMS (C-BAND)

STATSIONAR EXPRESS, THAICOM, MEASAT, KOREASAT & OTHERS

SATELLITE TV ASIA 93 - PLENARY SESSION I

FUTURE ASIA/PAICIFC SATELLITE SYSTEMS

IV. SATELLITE SYSTEM ANALYSIS

A. COVERAGE ZONES

B. POWER LEVELS (EFFECTIVE ISOTROPIC RADIATED POWER - EIRP)

C. TRANSPONDER CAPACITY & BANDWIDTH

D. OPERATIONAL FREQUENCY SPECTRUMS

E. SPECIAL FEATURES

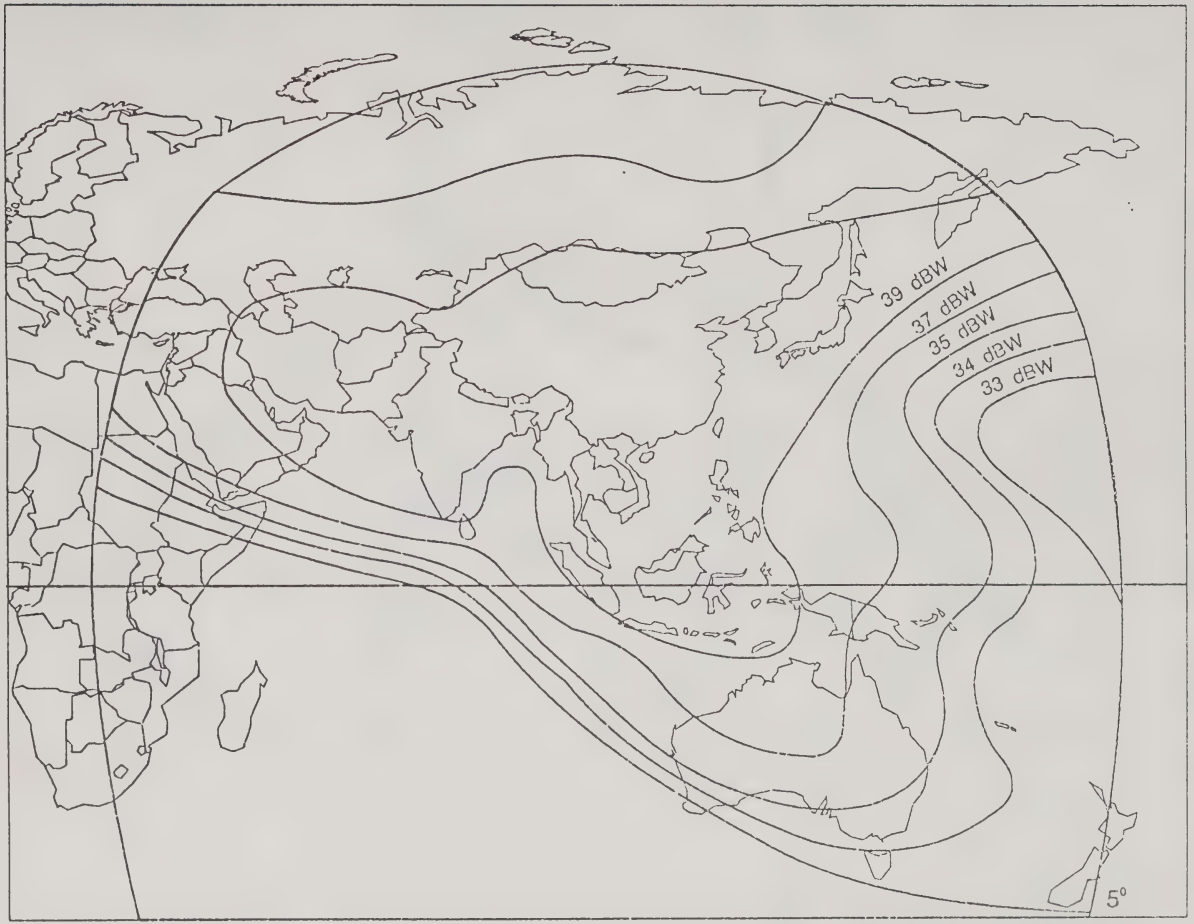
F. TIMETABLE FOR INTRODUCTION

AsiaSat 2 - Fact Sheet

Satellite	MM 7000; 3 Axis stabilized; weight 3,487kgs; Solar panel wing span 23 mtrs; In orbit life 15 years;
Available	Delivery 4th quarter 1994
Configuration	24 C-band; 9 Ku-band.
Location	100.5°E
Consultants	Communications Satellite Corporation (COMSAT) of the USA.
Market by country	China, Hong Kong, Taiwan, Thailand, Malaysia, Vietnam, India, Pakistan, Russia, Japan, Nepal, Korea, Laos, Cambodia, Iran, Bangladesh, Eastern Europe.
Market by usage	International Television Domestic Television Public Telecommunications Private Telecommunications
General	AsiaSat2 will be the most powerful satellite in the region providing high power services at both C (55 Watts) and Ku-band (115 Watts). The C-band footprint will cover 53 countries, 3.3 billion people and 63% of the world's population.

PRELIMINARY

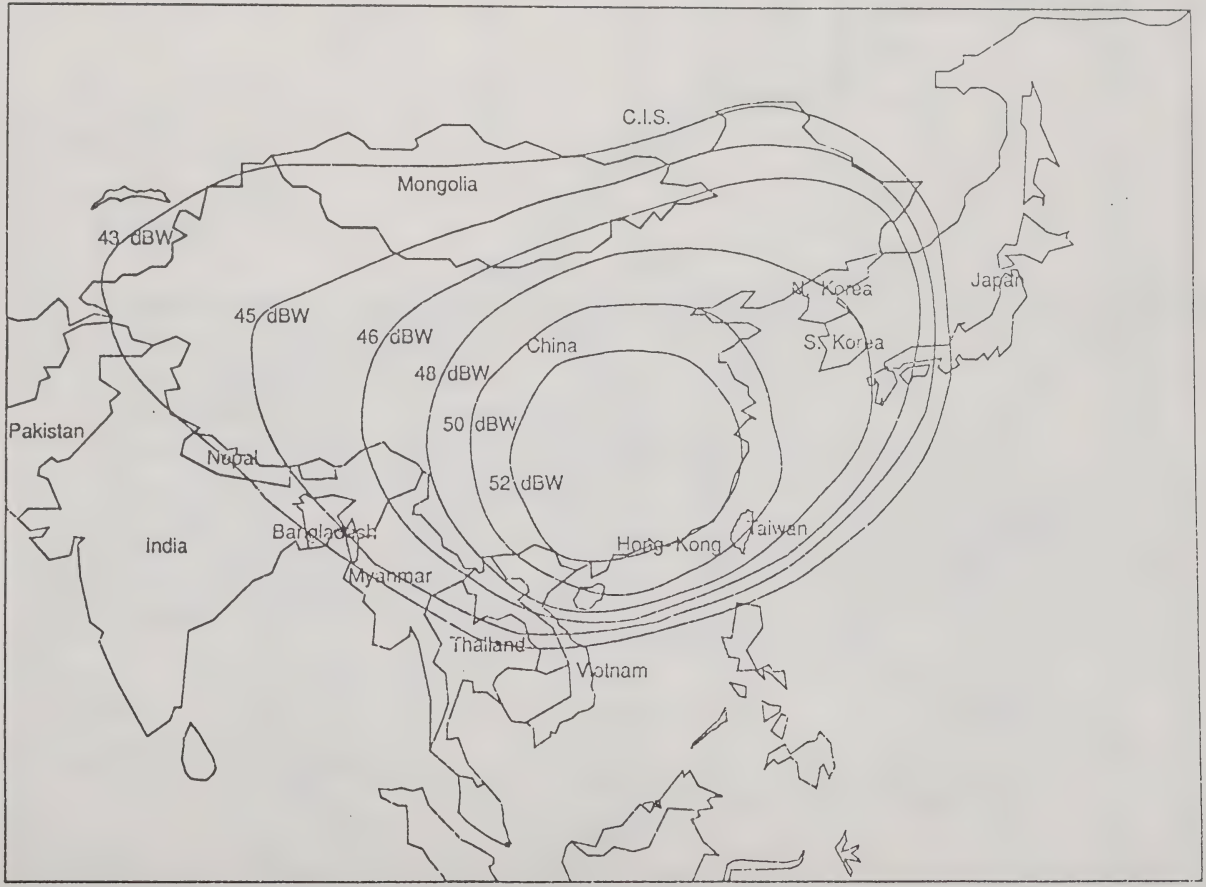
ASIASAT-2 (100.5°E) C-BAND EIRP (dBW)



AsiaSat

PRELIMINARY

ASIASAT-2 (100.5°E) Ku-BAND EIRP (dBW)



AsiaSat

Asia Satellite Telecommunications Co. Ltd.
AsiaSat-2 Technical Specifications

The spacecraft

Designed/Built by	:	MARTIN MARIETTA Astro Space
Model	:	MM7000
Weight at Launch	:	3.5 Tonnes
Orbital Manoeuvre Life	:	15 years
Stabilization	:	3 Axis Body-stabilized
Orbital Position	:	100.5°E

Communications Payload

C-band

Number of Transponders	:	24
Frequency Band	:	4/6 GHz
Transponder Bandwidth	:	20 transponders at 36 MHz and
		4 transponders at 72 MHz
Polarization	:	Linear: 12 Horizontal, 12 Vertical
EIRP	:	40 dBW max.
Coverage	:	China, Japan, Indonesia, India,
	:	Middle East, C.I.S.
TWTA size	:	55 watts
TWTA Redundancy Configuration	:	2 Groups 16 for 12
Receiver G/T	:	0 dB/K max.
Saturated Flux Density (SFD)	:	-97 ± 1dBW/m^2 max.
Receiver Reduncancy Configuration	:	4 for 2
Uplink Command Frequency	:	6423.5 MHz Vertical
Downlink Telemetry Frequencies	:	4197.5 MHz Horizontal
		4199.5 MHz Horizontal

Ku-band

Number of Transponders	:	9
Frequency Band	:	12/14 GHz
Transponder Bandwidth	:	54 MHz
Polarization	:	Linear: 5 Horizontal, 4 Vertical
EIRP	:	53 dBW max.
Coverage	:	China, Hong Kong, Taiwan, Korea
TWTA size	:	115 watts
TWTA Redundancy Configuration	:	12 for 9
Receiver G/T	:	6 dB/K max.
Saturated Flux Density (SFD)	:	-97 ± 1dBW/m^2 max.
Receiver Redundancy Configuration	:	4 for 2
Downlink Tracking Beacon Frequencies	:	12503 MHz Vertical
		12504 MHz Horizontal

... / 2

Launch

Launch Date	:	4 QTR 94/1 QTR 95
Launch Vehicle	:	Long March 2E
Launch Agency	:	China Great Wall Industry Corporation

Satellite Control Facility

Tracking Telemetry and Control	:	Stanley Earth Station, Hong Kong
Satellite Control Centre	:	AsiaSat Head Office Causeway Bay, Hong Kong

PRELIMINARY

AsiaSat

ASIASAT 2 100.5°E - C BAND

SATELLITE POWER IN FOOTPRINT COUNTRIES

Country	City	Azimuth (degree) 100.5°E	Elevation (degree) 100.5°E	EIRP (dBW)	G/T (dB/K)
Afghanistan	Kabul	133.1	37.4	39	-5
Australia	Sydney	114.36	23.8	35	-11
Bahrain	Bahrain	110.7	28.1	39	-3.5
Bangladesh	Dhaka	156.3	60.1	39	-3
Bhutan	Thimpu	157.6	55.7	39	-3
Brunei	Bandar Seri B.	252.4	72.7	39	-3
Cambodia	Phnom Penh	201.0	75.5	39	-2
China	Beijing	203.3	41.0	39	-4
	Guangzhou	209.8	59.4	39	-2
	Kunming	184.7	60.6	39	-3
	Chengdu	187.1	54.5	39	-3
	Shanghai	216.3	47.3	39	-3
Cyprus	Nicosia	103.6	9.9	38	-6
Egypt	Cairo	100.6	9.1	37	-5
Hong Kong	Hong Kong	212.6	59.5	39	-2
India	Bangalore	118.8	59.1	39	-4
	Hyderabad	127.3	58.7	39	-4
	Bombay	126.9	55.9	39	-3
	Calcutta	150.5	60.3	39	-3
	Madras	121.4	61.9	39	-4
	New Delhi	138.2	48.4	39	-4
Indonesia	Jakarta	315.3	79.6	39	-6
	Medan	147.9	85.3	39	-3
Iran	Tehran	116.5	24.6	39	-5

ASIASAT 2 100.5°E - C-BAND

SATELLITE POWER IN FOOTPRINT COUNTRIES

Country	City	Azimuth (degree) 100.5°E	Elevation (degree) 100.5°E	EIRP (dBW)	G/T (dB/K)
Iraq	Baghdad	110.0	20.6	38	-5
Israel	Tel Aviv	103.3	11.6	38	-5
Japan	Tokyo	234.4	31.6	39	-4
Korea	Seoul	219.6	38.9	39	-3
Kuwait	Kuwait	110.7	24.6	39	-4
Laos	Vientiane	186.8	68.8	39	-4
Malaysia	Kuala Lumpur	196.5	86.2	39	-3
Mongolia	Ulaanbaatar	188.8	35.0	38	-8
Myanmar	Yangon	164.8	70.0	39	-3
N. Korea	Pyongyang	219.1	37.5	39	-3
Nepal	Kathmandu	147.5	51.6	39	-3
Oman	Muscat	110.3	36.7	39	-3
Pakistan	Islamabad	135.9	42.0	39	-5
Philippines	Manila	235.3	60.5	39	-3
Saudi Arabia	Riyadh	106.6	24.4	39	-4
Singapore	Singapore	255.3	85.4	39	-3
Syria	Damascus	104.9	12.8	38	-5
Taiwan	Taipei	223.0	52.2	39	-3
Thailand	Bangkok	180.0	73.5	39	-2
Turkey	Ankara	104.4	8.2	38	-6

ASIASAT 2 100.5°E - C-BAND

SATELLITE POWER IN FOOTPRINT COUNTRIES

Country	City	Azimuth (degree) 100.5°E	Elevation (degree) 100.5°E	EIRP (dBW)	G/T (dB/K)
United Arab Emirates	Abu Dhabi	111.4	31.8	39	-4
CIS	Moscow	112.7	16.2	37	-8
	Vladivostok	221.7	31.2	39	-4
Vietnam	Hanoi	193.7	64.7	39	-2
	Ho Chi Minh C.	209.7	75.9	39	-2

April 1993

NOTES:

1. Azimuth Degree = Direction to point the antenna in relation to true North.
2. Elevation Degree = Angle of antenna in relation to the horizon.

THE THAICOM SATELLITE SYSTEM

by Dr. Avudh Ploysongsang, Project Manager, Shinawatra Group

Shinawatra Satellite is the name of our company. Our first satellite will be launched on December 17th, 1993. Arianespace is the launcher of our satellite. The irony is that the King himself give the name to the satellite system as Thaicom on December 17, 1991. Exactly two years later we will launch that satellite.

Shinawatra Satellite is part of the Shinawatra Group which has businesses in a couple of areas. Shinawatra itself started about ten years ago as a mainframe computer company.

Shinawatra Computer and Communications Group of Companies

—Leading telecommunication companies in Thailand
—3 business groups

Computer & Value Added Telecommunication systems, Telecommunication Mainframe Computer,

Services business Telecom Equipment, Cellular Phone, paging, Telephone systems, satellite communications

Broadcasting & Mobile Business (Cable TV, Radio)

From its modest start, the company expanded into telecommunication businesses, including satellite equipment, telephone switching systems, as examples. From there we entered the value added business, which includes cellular telephones, data communication network services and now satellite communications. The Shinawatra Group also includes other businesses such as pay TV, radio, and advertising. Pay TV service IBC (International Broadcasting Company)—our sister company—will be on Thaicom when we begin our direct broadcasting service.

And now for some background on the Thaicom project. In 1991, we were granted a thirty-year concession to acquire and operate the satellite system in Thailand by Thailand's Ministry of Transportation and Communication. During the thirty-year concession period we will be the sole operator. We founded Shinawatra Satellite to respond to this task and contracted with Hughes Aircraft to build our first satellites. We selected Hughes because of their good record. And the satellite design which we selected is one of the most reliable satellite platforms that exist today. We contracted with Arianespace to launch our satellites and selected Telespace to serve as our technical consultant.

The goal of our company is to be an international satellite service provider. Through transponder leasing, we intend to provide service to everyone under our footprint. We also plan to include the application of new technologies relating to the satellite, including satellite news gathering and the direct boradcasting service which we believe will be a very important business in Thailand.

Shinawatra Satellite COMPANY GOALS

—BECOME A MAJOR INTERNATIONAL SATELLITE SERVICE PROVIDER
—EXTEND OUR SERVICE TO THE NEXT GENERATION OF THAICOM
—PROVIDE TELECOMMUNICATION LINKS FOR THE ENTIRE REGION
—BECOME A LEADER IN NEW SATELLITE COMMUNICATION TECHNOLOGIES & SERVICES, SUCH AS DIRECT BROADCASTING, MOBILE SATELLITE COMMUNICATIONS, ETC.

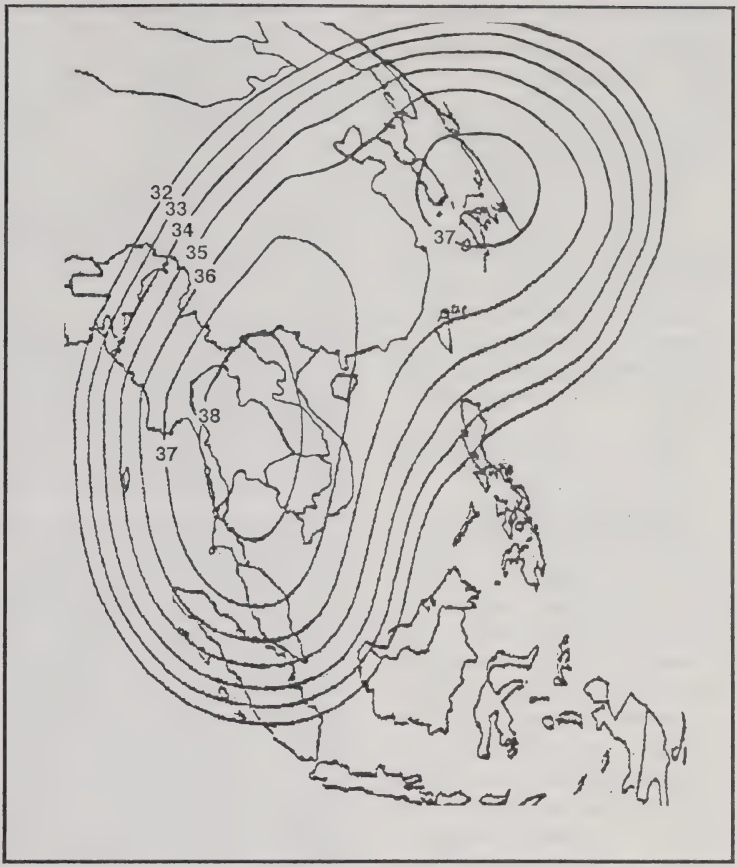
Our company is organized into five departments: the finance adm**inistration**; the **operation department**, which makes sure that we provide excellent service to our users; the **satellite engineering department**, which cooperates with the operation department to ensure that the satellite system is in top condition through system analysis with feedback to the satellite operators; the **application engineering department,** which looks into how to apply the satellite's

capabilities for most appropriate use in Thailand and anywhere else under the footprint; and the **commercial department** of which I am in charge. The commercial department, which will take care of the business side, including the leasing of transponders, is divided into sales, marketing, and marketing communication sections which will work as a team to provide the best possible customer service.

On each of our satellites, we have 10 C-band transponders with two backups and two Ku-band transponders will one backup. So when both satellites are collocated at 78.5 degrees east longitude—the result of our agreement with Asiasat—we will have a two satellite system with 20 C-band transponders and 4 Ku-band transponders.

C-BAND 10 EACH (PLUS 2 BACK UP) 6/4 GHZ UP/DOWN) EIRP TO 39.5 DBW OVER THAILAND BANDWIDTH 36 MHZ G/T 3-7 DB/K OVER THAILAND KU-BAND 2 EACH (PLUS ONE BACKUP) 14/12 GHZ UP/DOWN EIRP: UP TO 54 DBW OVER THAILAND BANDWIDTH 54 MHZ G/T 7-10 DB/K OVER THAILAND

Our C-band satellite footprint covers all the way up to Japan, Taiwan and Korea, and down to Southeast Asia. On Ku-band, the footprint covers Thailand and nearby countries. The power as you can see is high.

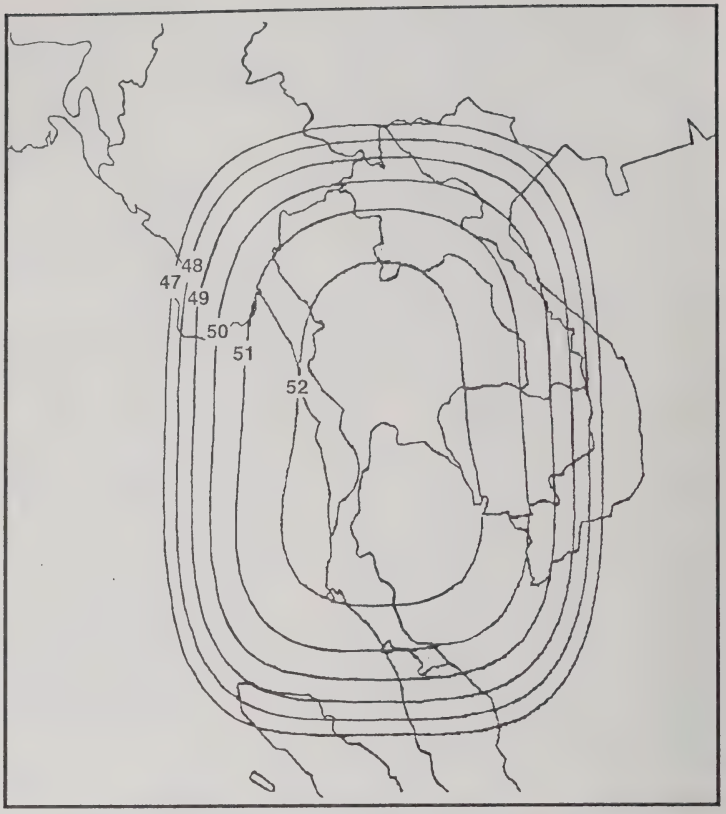


Thaicom's C-band coverage beam will reach from Japan, Korea, and Taiwan to Malaysia and Singapore.

Thailand's four VSAT operators, with collective installed base of up to 2,000 terminals, will become one of our customer bases. The five commercial Thai TV broadcasting channels (3, 5, 7, 11, & 13) also will become customers, along with our new business in direct broadcasting which I will get into a little later in more detail. Thai Telecom authorities and government agencies—including the military—also will be using the satellite. We also hope that Thai private enterprise services will also be expanding their satellite useage in the near future. Of course, Laos and Cambodia will be using our satellites. We already have reached agreement will the governments of both countries to provide them with telecommunications services.

THAICOM USER PROFILE IN THAILAND

—4 VSAT OPERATORS: UP TO 2,000 TERMINALS
—5 CHANNELS OF TV DISTRIBUTION (C-BAND)
—DIRECT BROADCAST TV (KU-BAND) UP TO TEN COMMERCIAL TV CHANNELS, UP TO 6 EDUCATIONAL TV CHANNELS
2 TELECOM AUTHORITY STATE ENTERPRISES (CAT, TOT)
—ALL FOUR MILITARY FORCES (ARMY, NAVY, AIR FORCES, SUPREME)
—CURRENT 16 GOVERNMENT AGENCIES, AND MORE TO COME
—EXPANIDING PRIVATE ENTERPRISE USERS
—LAOS AND CAMBOADIA FOR TV AND TELEPHONE



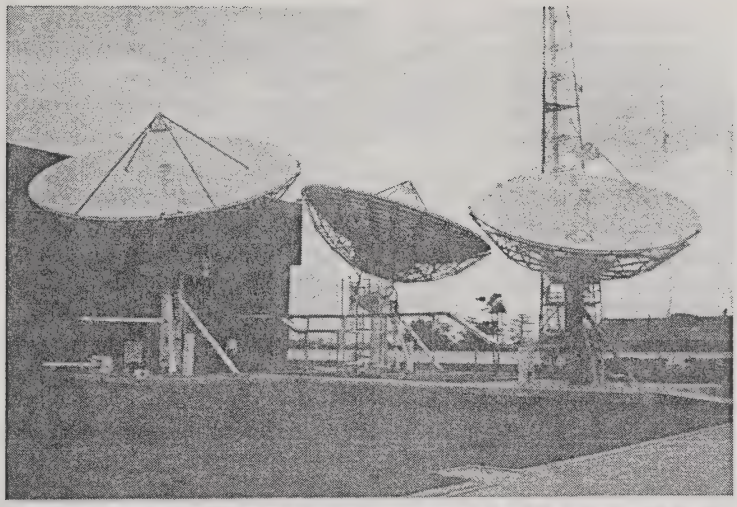
Thaicom Ku-band Beam Coverage from 78.5 degrees East.

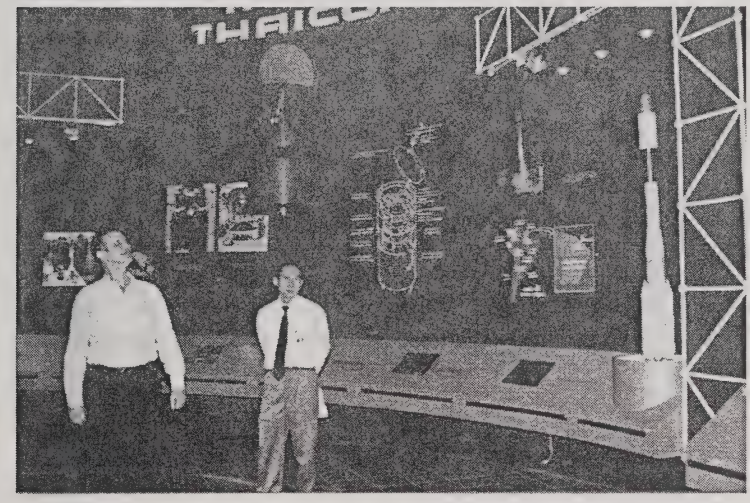
The telephone system will be another major user. Thaicom can serve as a trunk circuit to connect to the public switched nework, or for thin route applications, especially in remote villages. The Telephone Organization of Thailand (TOT) intends to start a new project in this area.

In television application of course you can use the satellite for the distribution of television newtworks, connecting from the main broadcast station's studios to remote sites for VHF or UHF rebroadcasting or for Satellite News Gathering applications where live news feeds or special events are relayed from any location under the footprint back to the main station for rebroadcasting. Or you can use the satellite for direct broadcasting TV signals direct to the home or to any satellite master antenna for redistribution by cable or MMDS.

Let me talk a little bit more about the direct-to-home application using Thaicom. Direct-to-home broadcasting is not a new idea. There are several systems in operation already in Europe and Japan. The system that we are talking about for Thailand, however, has some new things to it. Existing systems do not have the digital compression technology application. However Thaicom will have this technology included. Hughes DirecTv will be the first system to use digital video compression for direct-to-home applications. Thaicom will be the second to go into operation.

With this type of system, the TV studio which produces the programs will send the television signal through a microwave link to a facility conveniently located at the





Thaicom uplink anntennas (top) and media room (bottom). Photos courtesy CQ International.

Thaicom station, where the TV signals from several channels will be combined or multiplexed using compression encoding equipment and uplinked to the satellite. From the satellite, the signal will come down to each house equipped with a small satellite dish, and an IRD (integrated receiver/decoder). The IRD will decode the compressed signal, and expand it for normal viewing on a regular TV set.

The compression equipment that we will use will be selected from among three companies who are leaders in the field: Scientific Atlanta, General Instrument and Compression Lab Inc. (CLI). We hope to be able to conclude the selection soon. The criteria that we are using for the selection process includes the technical, financial, and commercial requirements for obtaining the best quality system at a low-cost price for the Thai people.

At the beginning the equipment will be somewhat expensive and there will be a limited number of units available. However, it is our policy to drive the cost down as soon as possible for the widespread use throughout the country.

TV signals can be sent either direct to the home, or received by remote sites for rebroadcast in remote areas. So using this system, the normal way of TV transmission still can be used, but it also gives home users the option of picking up the signal directly from the satellite, thereby obtaining a very clear signal because it is a digital system.

DIRECT TO HOME BROADCASTING (DTH) VIA THAICOM'S SATELLITE
—NATIONWIDE COVERAGE BY ONE UPLINK STATION
—BETTER QUALITY AND SOUND BY DIGITAL TECHNOLOGY
KU-BAND CASE
—HIGH LEVEL OF EIRP (MORE THAN 50 DBW) REQUIRES SMALLER ANTENNA
—APPROPRIATE FOR HOUSEHOLD USE
—LESS INTERFERENCE THAN TERRESTRIAL SYSTEMS
—CAN BE USED FOR REBROADCASTING

television channel to set up a broadcasting system. Once you beam it up to the satellite you get coverage nationwide including maybe nearby countries too. You don't have to set up a network that cost a lot of money. You can even include bi-lingual or multi-lingual audio signals as part of the TV transmission.

Because of the EIRP values previously shown and of course because of the high frequency of the Ku-band satellite trasmissions, our engineers have calculated that we will be able to use a dish size of about 60 to 80 cm. The Hughes DirecTV system will be able to use a little bit smaller dish because they have less rain in the U.S. We are selecting a dish that is a little bit larger to provide a greater rain fade margin that is more appropriate for Thailand.

Not all homes in Thailand have backyards big enough to accommodate big dishes. And the amount of interference will be very little or none at all compared to terrestrial TV distribution systems. In Bangkok we have a lot of tall buildings, with more going up every week. With a satellite distribution sytem, those buildings will not block TV signals any more.

Marketing research conducted by DirecTv has shown that they will sell an estimated one million receiver units in their first year, which is interesting because the cable business is very widespread in the US already. That number helped us to project that we will have a very good direct-to-home business in Thailand, where not all channels are received clearly by every house.

What kind of programs can be provided by direct satellite broadcasting? News channels can be on the sytem, sport channels, super stations, data and business information broadcasting, advertiser-supported and pay TV movie channels, documentaries and science programs.

Another important type of programming that we are looking into is for distance learning. Right now we have several projects with several educations institutions in Thailand. Shinawatra Satellite is working with these institutions to provide a distance learning service through our direct broadcasting system. Shinwatra Gropup has set up a foundation called Thacom Foundation which will donate one direct-to-home TV channel for this purpose with the cooperation of a department under the Educational Ministry. The Department of Informal Education will provide the programs and the Thaicom Foundation will provide the channels. A university can send the signal out and get to a remore education center or even directly to the home of anyone who registers for the course.

QUESTION: I would like to know more about the distance education program and how the Thaicom satellites will be used to improve the lives of people who live outside the Bangkok area.

Dr. AVUDH: I mentioned earlier about the Thaicom Foundation which will donate one free direct broadcast channel for this purpose. The Ministry of Education of Thailand will provide the program material. They have a plan to set up a center for producing this kind of program. We have a lot of students who pass through the required primary school level but never continue their education—somewhere in the order of 40 or 50 percent. Many people would like to have more education if it is more convenient. Through thaicom, we will broadcast the educational programming and they will receive it either directly at their homes or at education centers, schools, or public libraries. The Thaicom Foundation has a plan to install receiving systems at remote village and community centers to provide the initial startup in the long distance education program.

Of course we have a project with several open universities that already are in the distance learning business. Today hey use either short

broadcasts through TV or radio or send materials through the mail. Through Thaicom, these universities would be able to provide a 24 hour classroom for everyone who would register or maybe even for free to anone who would like to continue their education at the university level. We plan to have at least about four or five channels of those education programs.

QUESTION: You mentioned five channels of TV broadcasting in the C-band and another 10 in Ku-band. Will they be the same broadcasting or will they be different?

DR. AVUDH: Let me explain this way. The commercial TV channels are now using C-band for their transmission inter-network for rebroadcast. They now use Palapa and Intelsat satellites. Under our agreement with the ministry of transportation and communications, Thai customers who use satellite services will be using the Thaicom satellite. Customers will be able to choose to remain on c-band or to be part of our new direct-to-home Ku-band broadcasting system. By using Ku-band, they would have direct-to-home in addition to normal relay network. At this moment it is at the discussion level as to what is best for them. We will try to provide the best deal for everyone. We believe that direct broadcasting is the best way to go.

QUESTION: You mentioned that there will be a few suppliers of Compression/MPEG technology. Will they be compatible or will they be different?

DR. AVUDH: It will be MPEG standard. Inside that there will be a certain part that is proprietary to each company. This technology requires a lot of research and development so it is understandable that people who are in this business would like to get some return for their investment. So there will be some proprietary part which will belong to each company.

We will try our best to put in the best system that is suitable for Thailand which the quality is the most important thing and then the cost of the units for the consumer. We plan to drive the cost down as soon as possible. We plan to have it produced in Thailand, or at least in the beginning, assembled in Thailand. But there will be some units at the initial start up of the program that will be imported. But we will try our best to get it produced in Thailand as soon as possible. At the beginning the supplier will provide the hardware because they have a production line set up that can produce the first batch for import.

QUESTION: Thaicom has compromised with Asiasat, moving its orbital slot from 101 to 78.5 degrees East. Do you think that Thaicom gained or lost something from this compromise?

DR. AVUDH: Both sides win. Asiasat had reserved two slots at 100.5 and 77 degrees East. Thaicom had reserved slots at 101 and 78.5 degrees East. We have reached an agreement with Asiasat. We will not send any satellite to 101 and at the same time they will not send any satellite to 77. With that agreement we will have our two satellites collocated at 78.5. We can look at it as one big satellite and there will be no intereference with Asiasat. Also the 78.5 slot is done in terms of frequency coordination. At 101 there would be something more to do in terms of frequency coordination. So both sides solved the interference problem. By collocating both Thaicoms we will not lower our EIRP. It will be approximately the same. The benefit of having the two satellites together is that we will have all of our transponders at a single location, so receiving stations can get all available channels without having to move the dish from one Thaicom satellite to the other. Also we will have more Ku-band transponders for direct broadcasting purposes at a single orbital location.

INTELSAT SPACECRAFT PERFORMANCE COMPARISON
(beam edge e.i.r.p. in dBW)

Coverage	Spacecraft				
	I-V	I-VI	I-VII	I-VIIA	I-VIII
C-Band Hemi/Zone	29	31	33	33	34.5/36 *
C-Band Global	23.5	26.5	26	29	29
C-Band Spot	32.5	n/a	33	36	n/a
K-Band Spot*	41/44	44/47	44.5/47	47	44/47

* e.i.r.p. levels for both outer and inner coverages provided.

Communications Subsystem Comparison
of INTELSAT Spacecraft

Description	INTELSAT VI	INTELSAT VII	INTELSAT VIIA	INTELSAT VIII
Max. available transponders: C-band Ku-band	 38 10	 26 10	 26 14	 38 6
Max. useable bandwidth for commercial services (MHz)	C-band: 2314 Ku-band: 886	C-band: 1526 Ku-band: 882	C-band: 1526 Ku-band: 1330	C-band: 2310 Ku-band: 602
Extent of frequency reuse for hemi/zone coverage	Six (6) times	Four (4) times with enhanced connectivity	Four (4) times with enhanced connectivity	Six (6) times with alternative for five (5) times with very enhanced connectivity

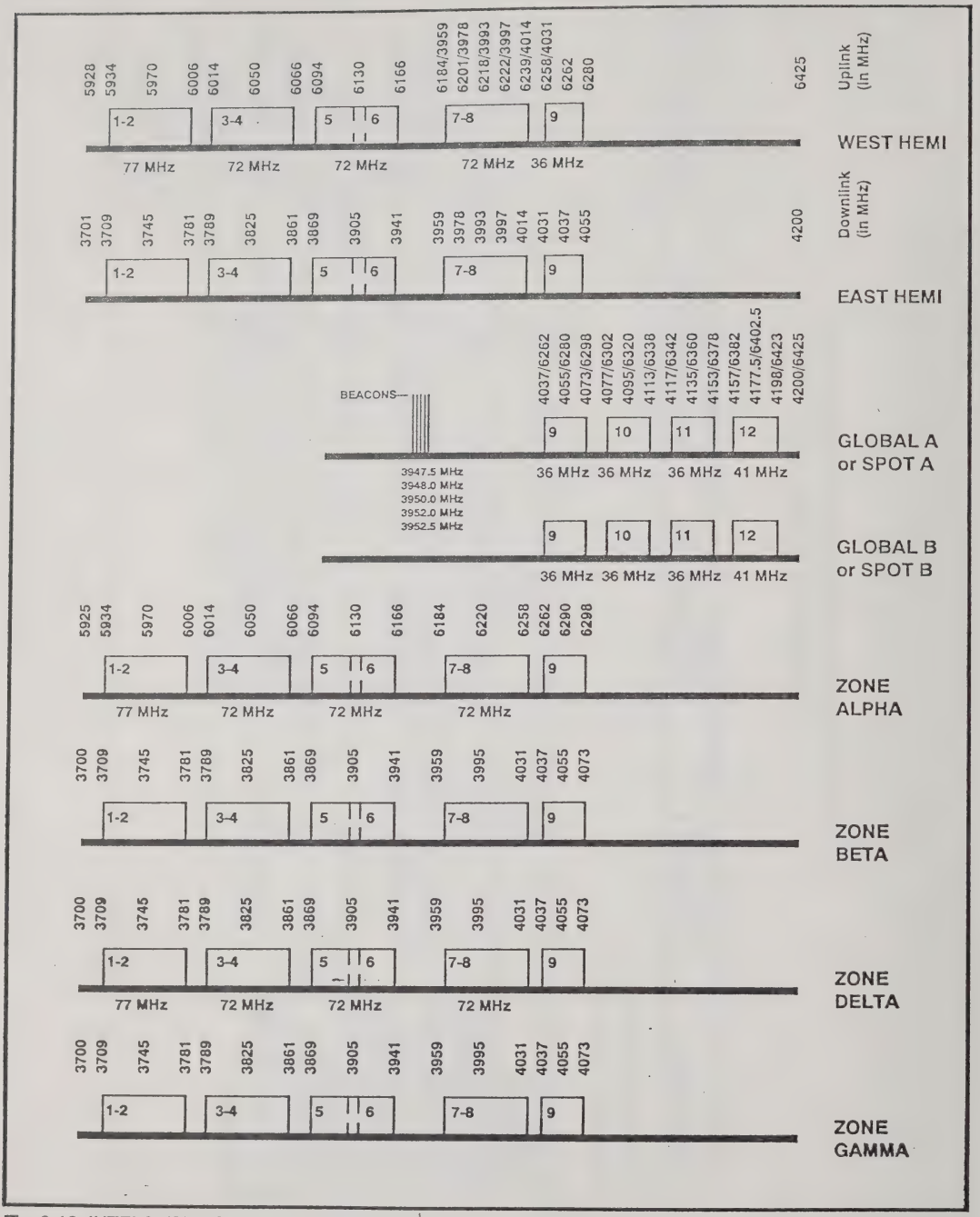


Fig. 3-18. INTELSAT VII C-band transponder layout

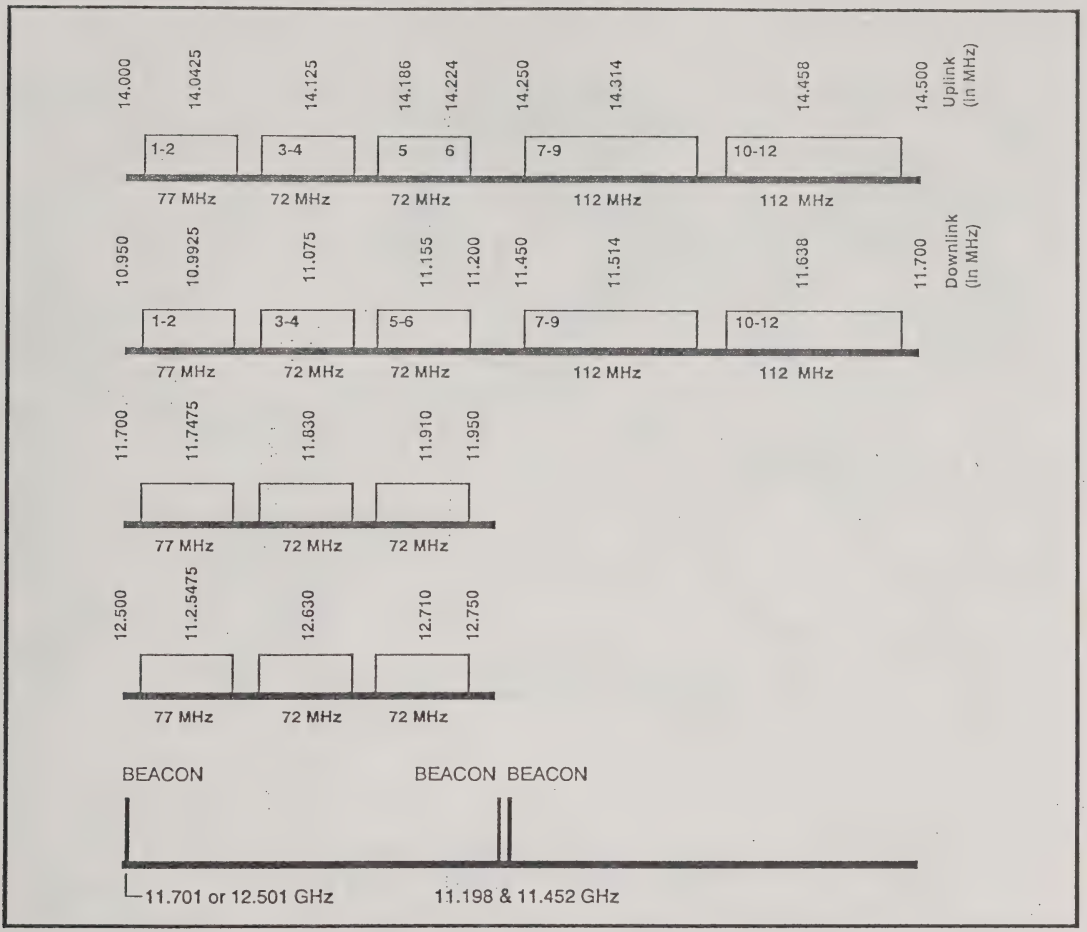


Fig. 3-19. INTELSAT VII Ku-band SPOT 1, 2, OR SPOT 3 transponder layout

1 Ku-band Steerable Spot Beam Antennas (S1, S2, S3) **2** C-band Receive Hemi/Zone Antenna Reflector **3** C-band Steerable Spot Beam Antenna **4** Thermal Radiator **5** Solar Array **6** C-band Global Coverage Horns **7** C-band Transmit Hemi/Zone Antenna Feed Array **8** Hinges (Single Pivot Deployment Mechanism) **9** C-band Transmit Hemi/Zone Antenna Reflector

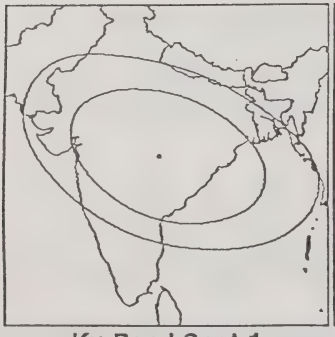
Fig. 3-20. INTELSAT VII Structural Layout.

Coverage Maps for Selected Future Satellites in the Indian Ocean Region (Typical Ku-Band Spot Beam Pointing)

INTELSAT 704 at 66°E

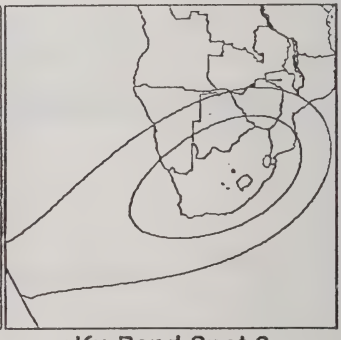
C-Band

C-Band Spot



Ku-Band Spot 1

Ku-Band Spot 2

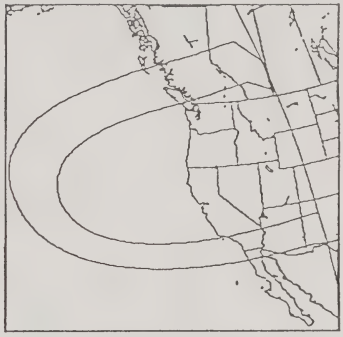


Ku-Band Spot 3

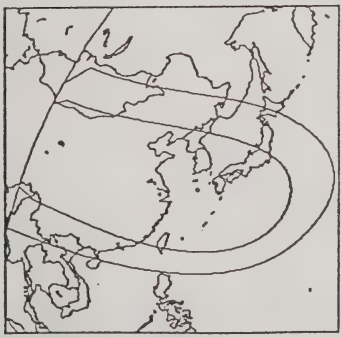
Coverage Maps for Selected Future Satellites in the Pacific Ocean Region (Typical Ku-Band Spot Beam Pointing)

C-Band

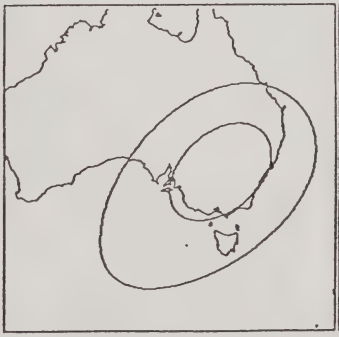
INTELSAT 701 at 174°E



Ku-Band Spot 1



Ku-Band Spot 2



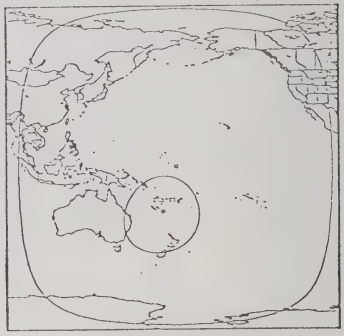
Ku-Band Spot 2A

Ku-Band Spot 3

Coverage Maps for Selected Future Satellites in the Pacific Ocean Region (Typical Ku-Band Spot Beam Pointing)

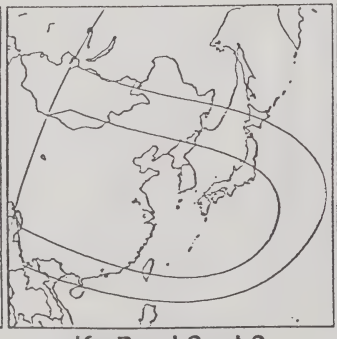
C-Band

INTELSAT 703 at 177°E

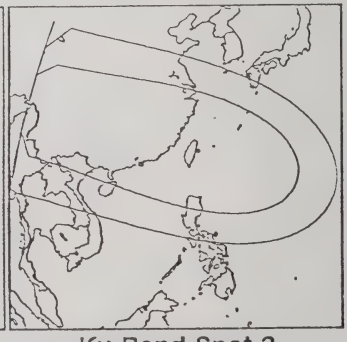


C-Band Spot

Ku-Band Spot 1



Ku-Band Spot 2



Ku-Band Spot 3

Coverage Maps for Selected Future Satellites in the Pacific Ocean Region (Typical Ku-Band Spot Beam Pointing)

INTELSAT 801 at 174°E

C-Band

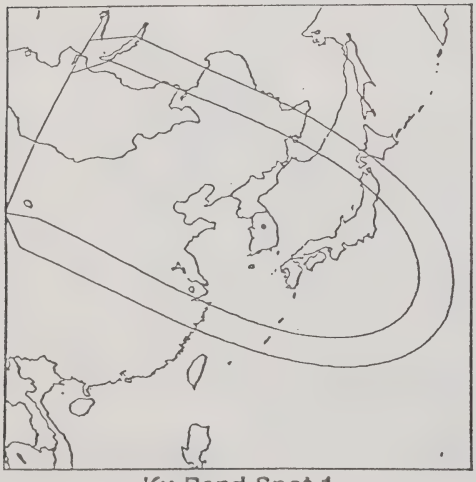
Ku-Band Spot 1

Ku-Band Spot 2

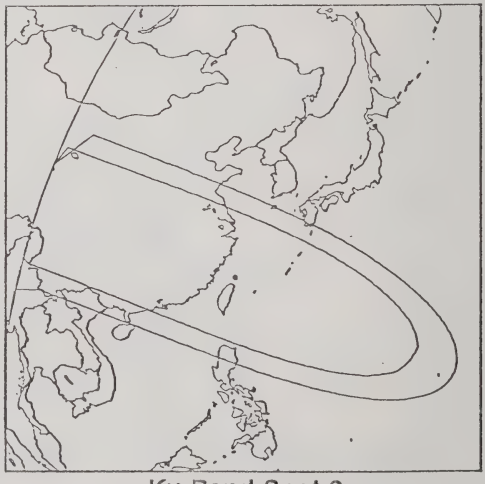
Coverage Maps for Selected Future Satellites in the Pacific Ocean Region (Typical Ku-Band Spot Beam Pointing)

INTELSAT 802 at 177°E

C-Band



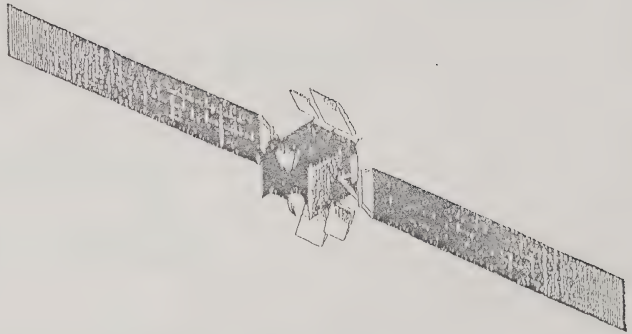
Ku-Band Spot 1



Ku-Band Spot 2

PanAmSat

GLOBAL
SATELLITE
SYSTEM



PAS-1

- Launched on Ariane 4 rocket in June 1988.
- GE series 3000 satellite with 24 C-band, 24 Ku-band transponders.
- Atlantic Ocean Region service through 2001.

PanAmSat

Superior Coverage

Transoceanic Reach

Regional Power

PanAmSat

PanAmSat

Founded in 1984,
PanAmSat became
the first private international satellite service provider
with the launch of PAS-1 in
June 1988.

PanAmSat's Mission

Provide the highest quality
international satellite services
directly
to programmers and
digital network customers
around the world.

PanAmSat

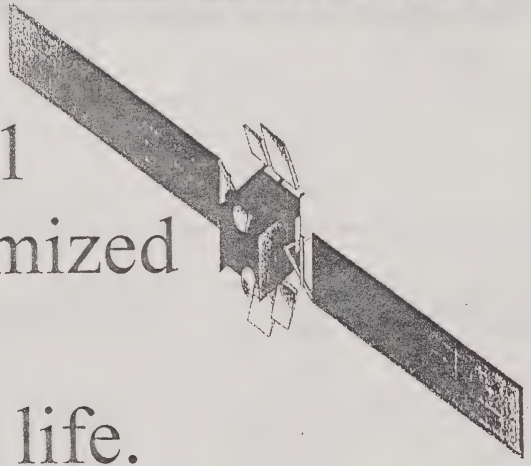
The New Satellites

Satellite	Ocean Region	Launch Window Arianespace	Orbital Slot
PAS-2	Pacific	May 1994	191° WL
PAS-3	Atlantic	Nov./Dec. 1994	43° WL
PAS-4	Indian	Feb 1995	68°/72° EL

Ground spare ready for launch in 11 months.

PanAmSat

The New Satellites



- Hughes HS-601 bus with customized payload.
- 15-year design life.
- Optimized for digital traffic.

PanAmSat

New Satellite Design

	KU-BAND	C-BAND
Transponder Output	63 Watts	34 Watts
Redundancy:		
TWTAs	10:8	10:8
Receivers	4:2	4:2

PanAmSat

Look Angles
ASIA-PACIFIC TO PAS-2

City	Elevation
Bangkok	13.00°
Brisbane	54.00°
Fiji	66.00°
Hong Kong	26.00°
Jakarta	20.00°
Kuala Lumpur	15.00°
Manila	34.00°
Micronesia	75.00°
Melbourne	40.00°
Osaka	37.00°
Seoul	29.00°
Singapore	17.00°
Sydney	46.00°
Tahiti	37.00°
Taipei	31.00°
Tokyo	39.00°
Vladivostok	42.00°

PanAmSat

Technical Advantages

- High transmission power.
- Beam-shaping technology.
- Cross-strapping.
- Linearization.

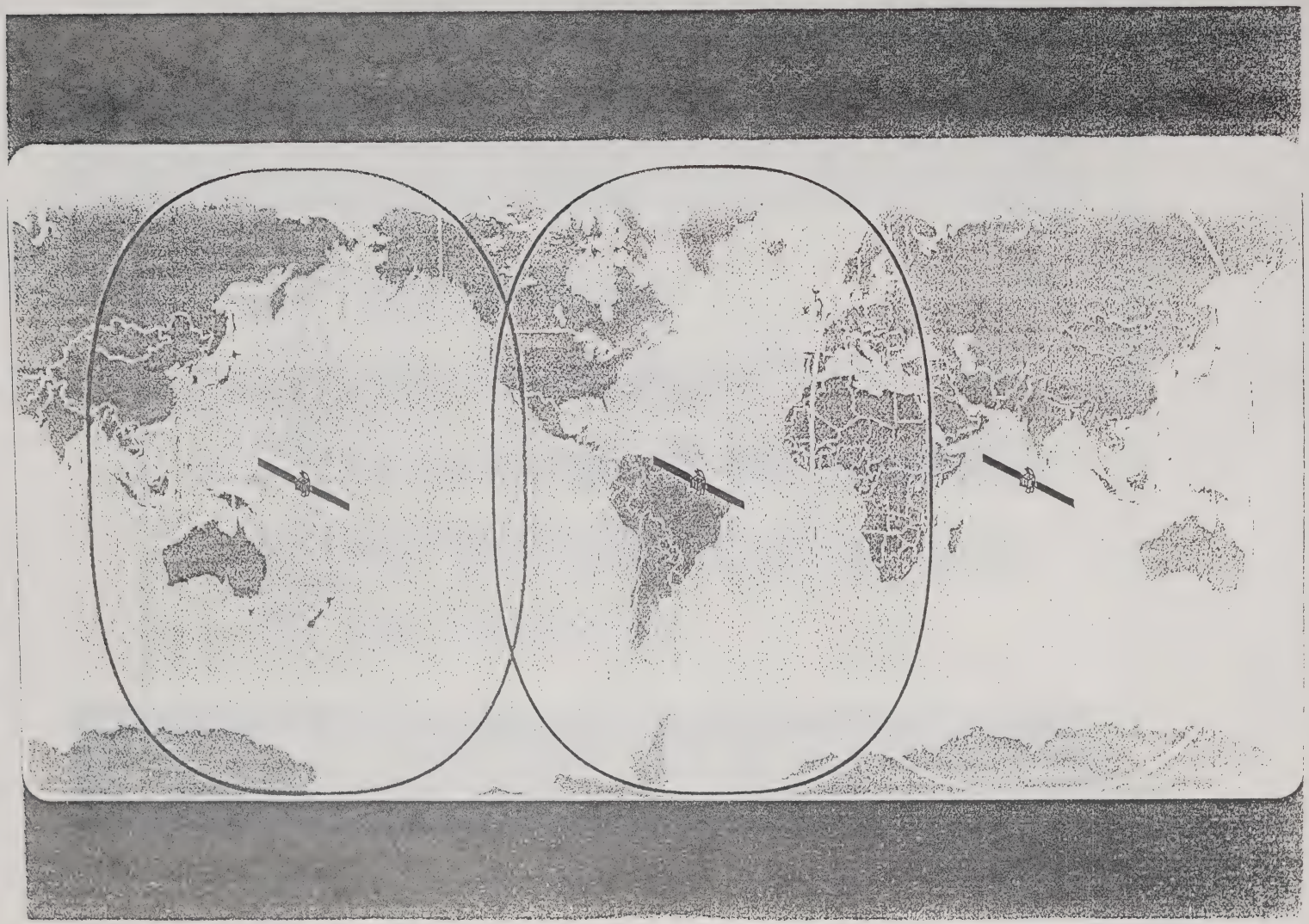
PanAmSat

Technical Advantages

- High transmission power.
- Beam-shaping technology.
- Cross-strapping.
- Linearization.

PanAmSat

PanAmSat World View



PanAmSat, Inc.

- Total management control of the satellite system.
- Licensed by the U.S. Federal Communications Commission.
- Under U.S. legal jurisdiction.

PanAmSat

Accomplishments

- Over 250 customers in over 70 countries.
- Leading satellite for program distribution in Latin America.
- Virtually sold out on PAS-1 by late 1992.

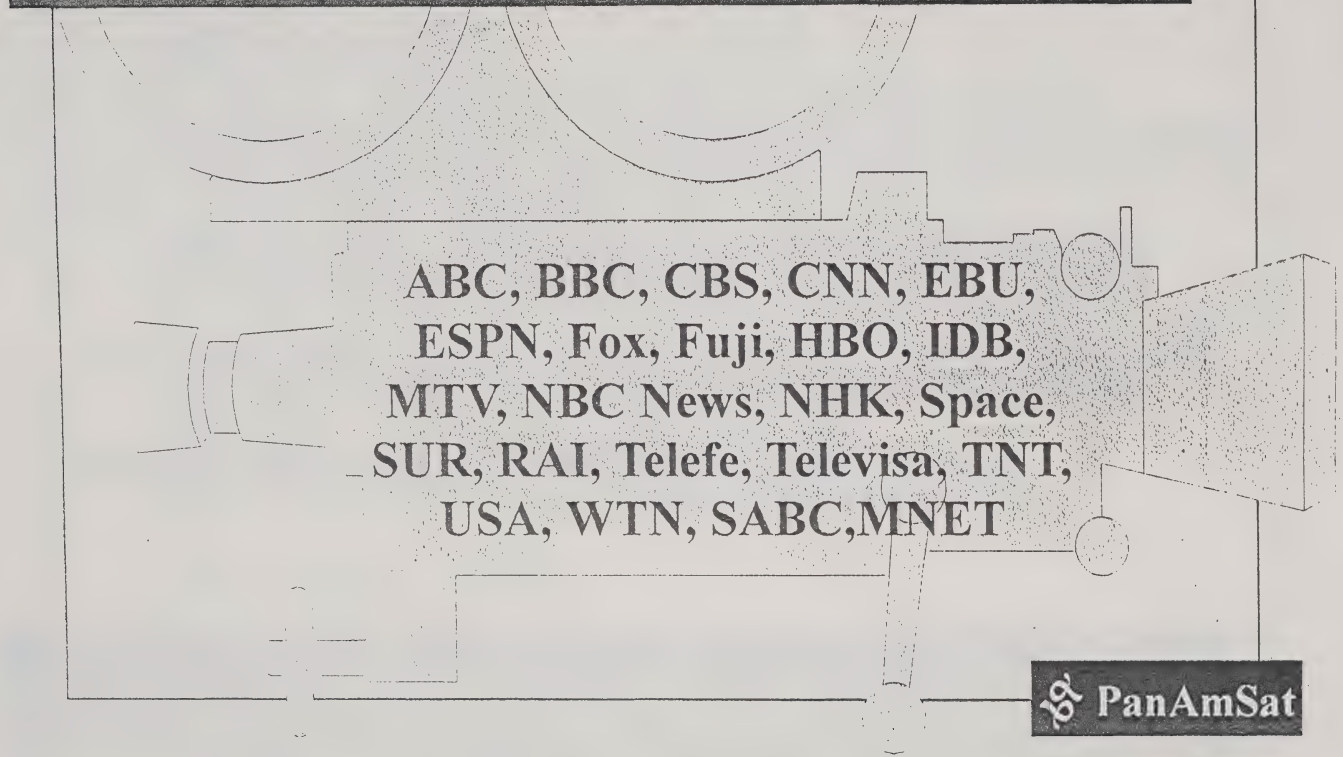
PanAmSat

Digital Networks

- Space segment only.
- End-to-end services, including satellite capacity and ground equipment, for private business networks.

PanAmSat

Broadcast
CUSTOMERS

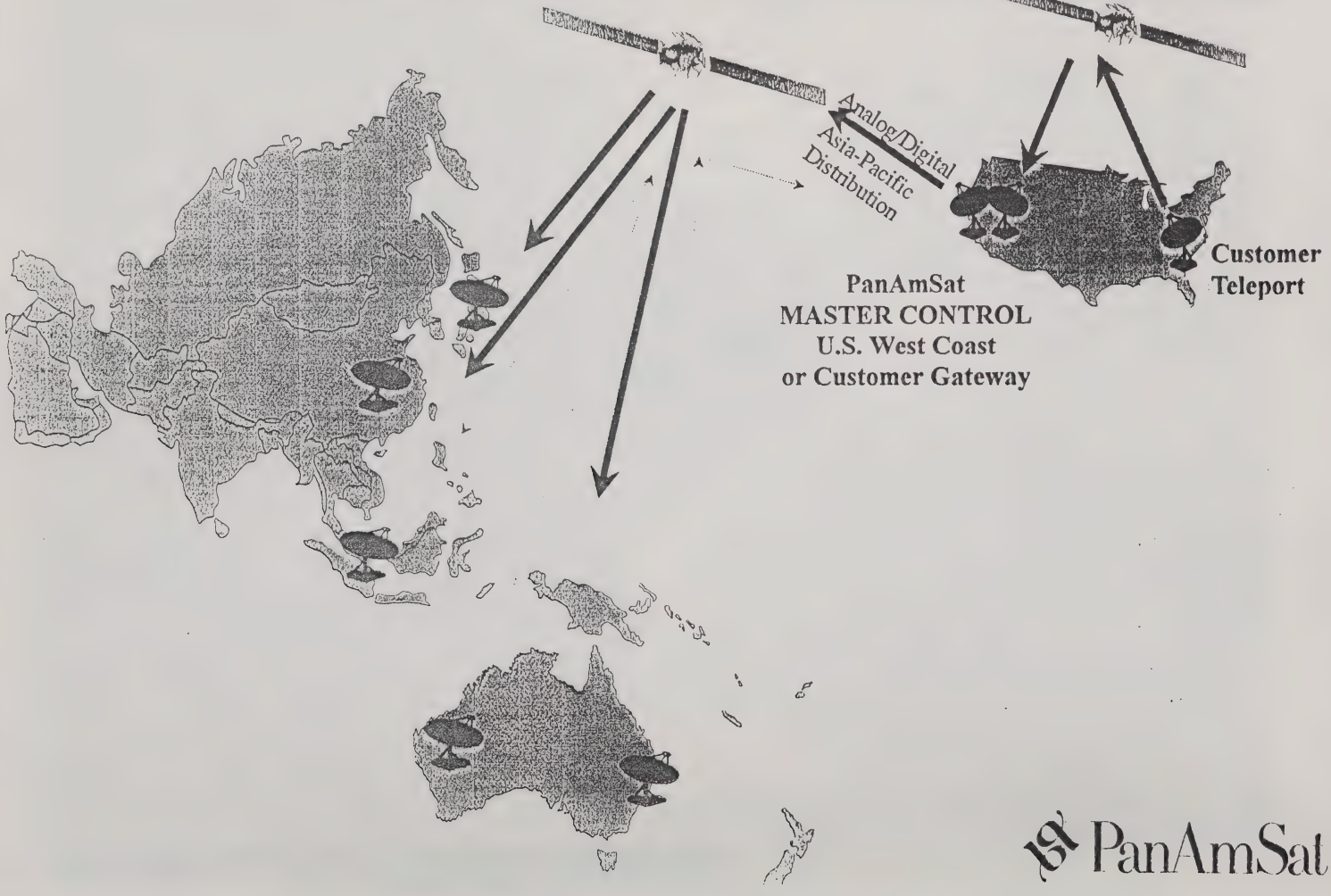


**ABC, BBC, CBS, CNN, EBU,
ESPN, Fox, Fuji, HBO, IDB,
MTV, NBC News, NHK, Space,
SUR, RAI, Telefe, Televisa, TNT,
USA, WTN, SABC,MNET**

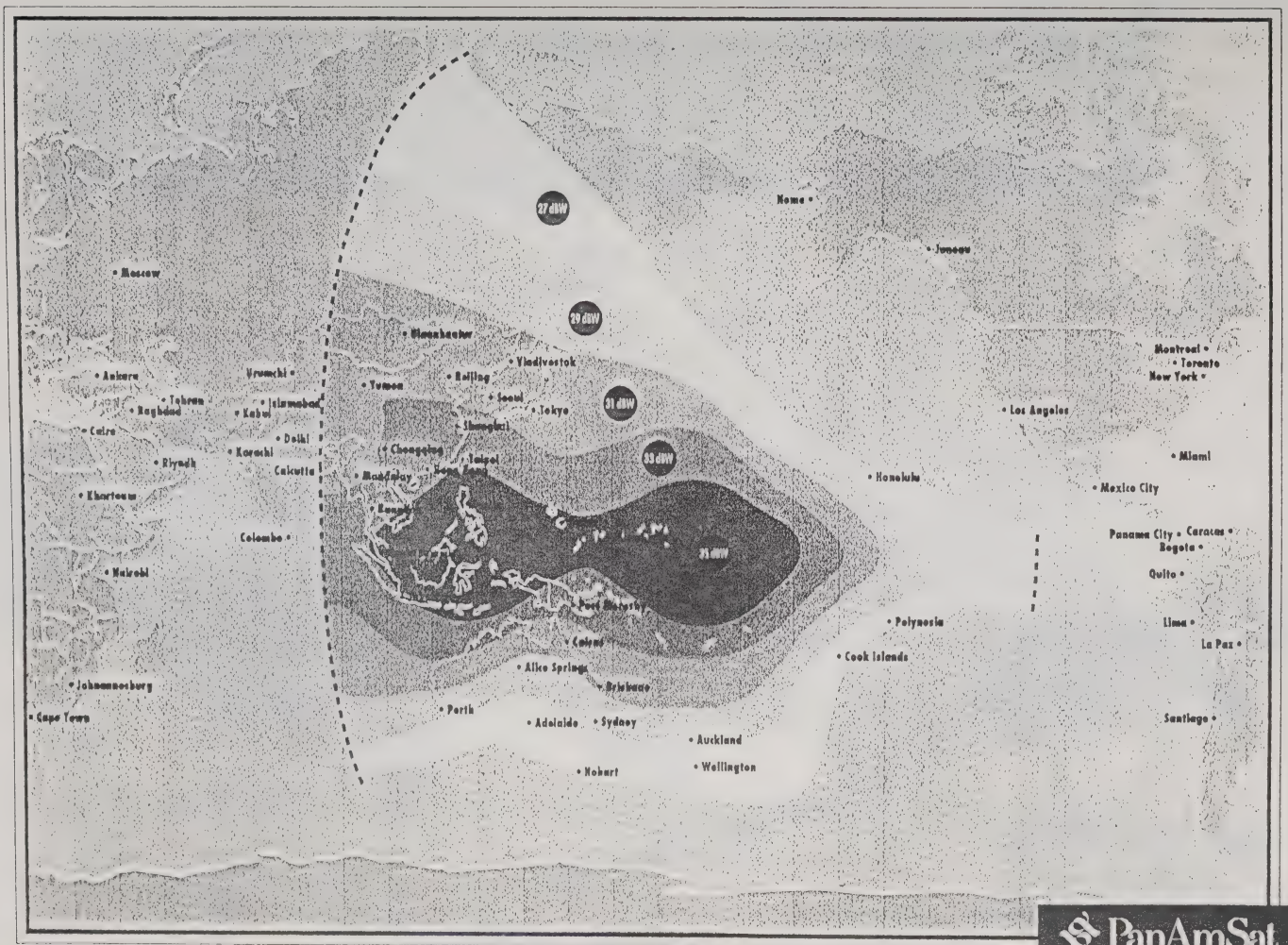
PanAmSat

PanAmSat

Asia-Pacific Distribution Services

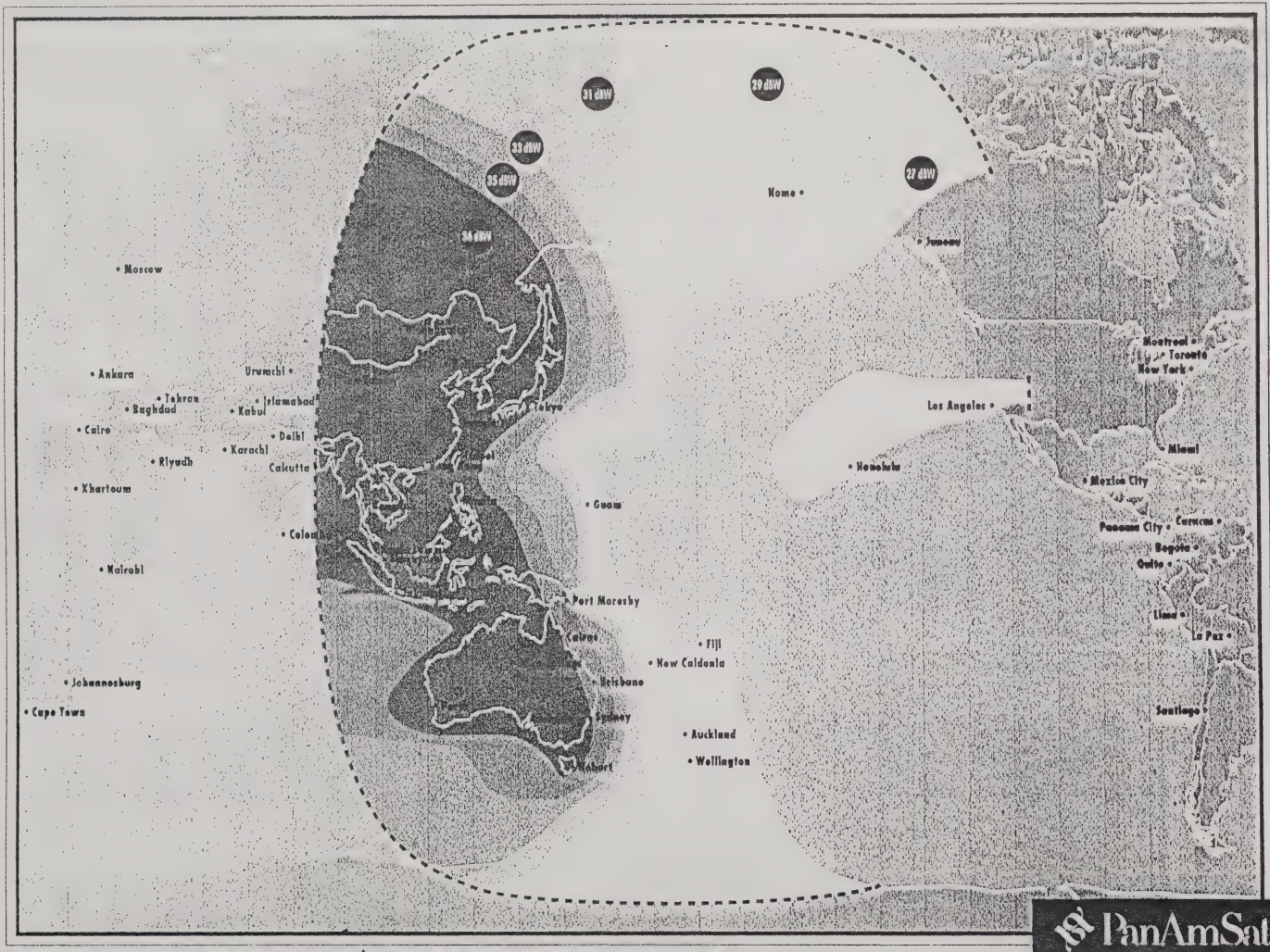


PanAmSat

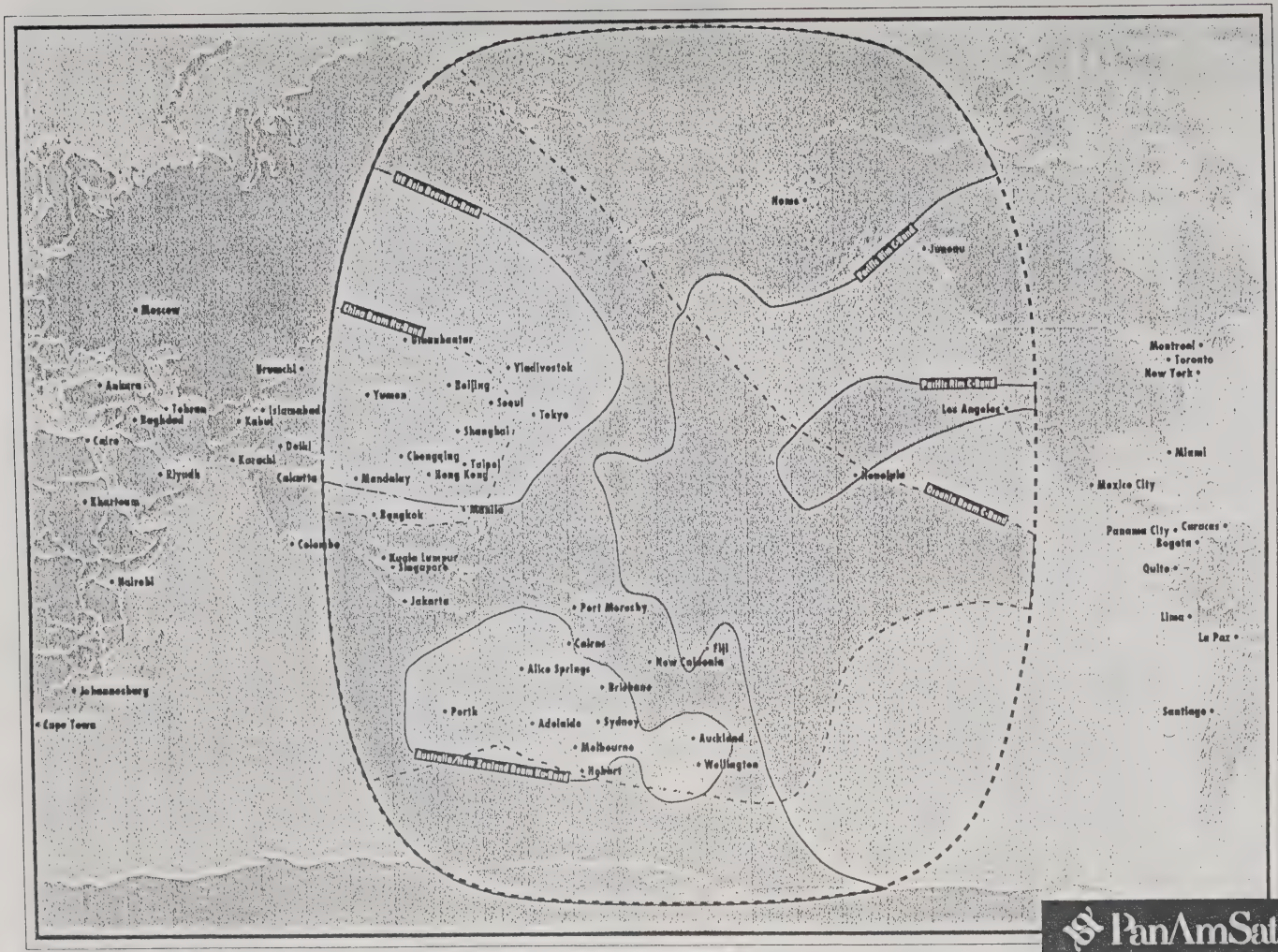


PanAmSat

PAS-2 Oceania Beam • C-Band



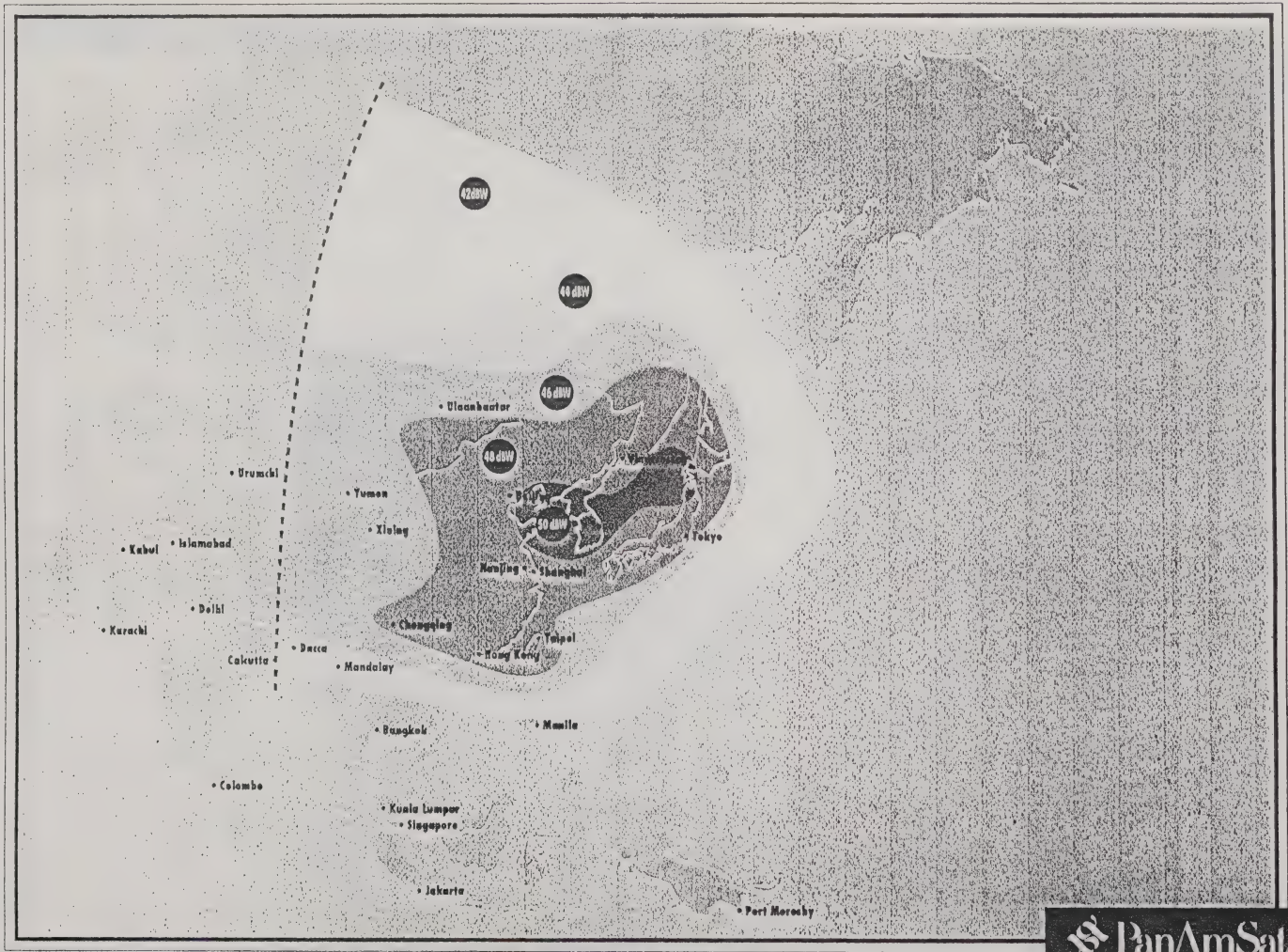
PAS-2 Pacific Rim • C-Band



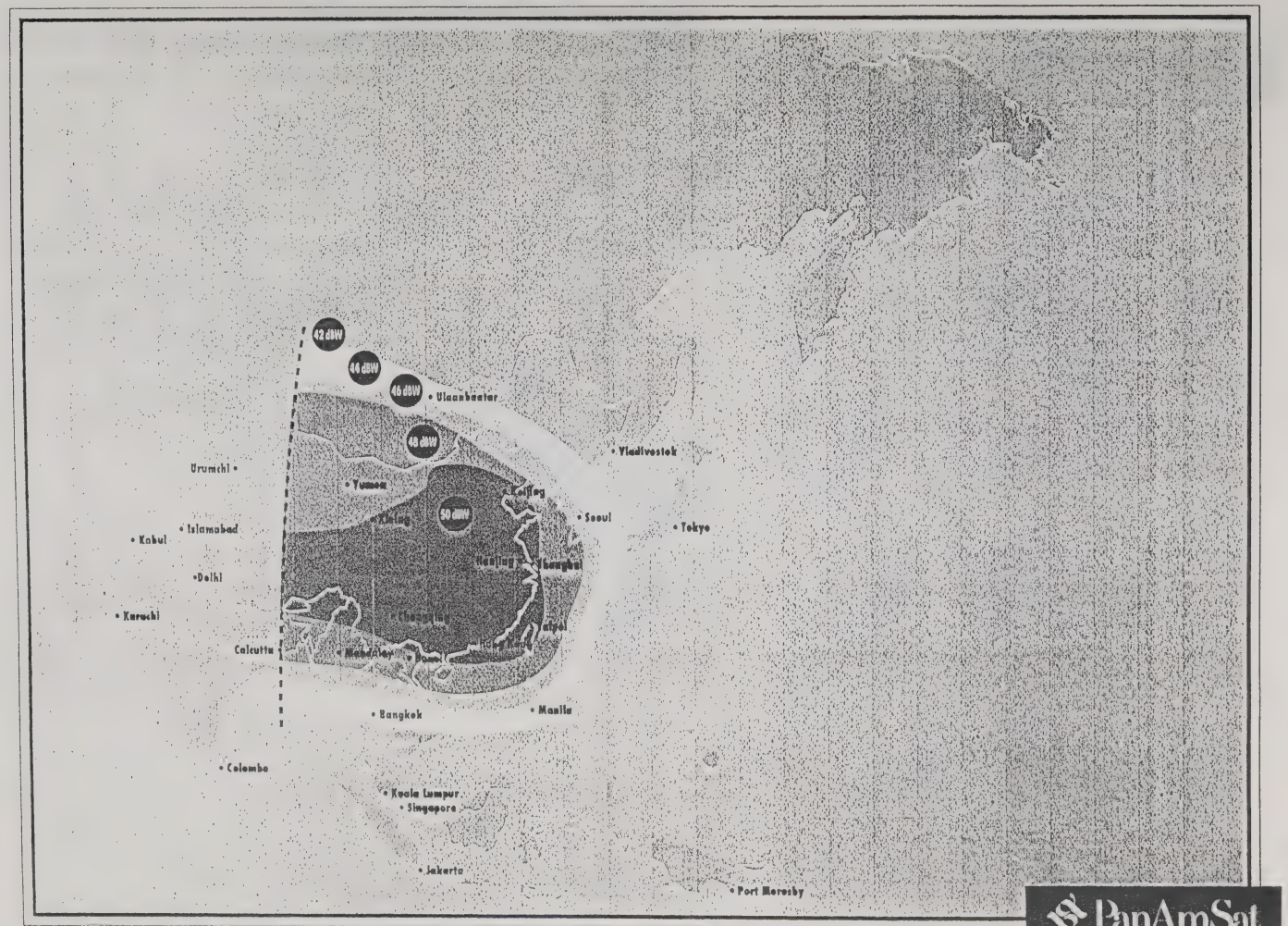
PanAmSat

PAS-2 Pacific Ocean Region

Ku-Band & C-Band
Downlink Beams

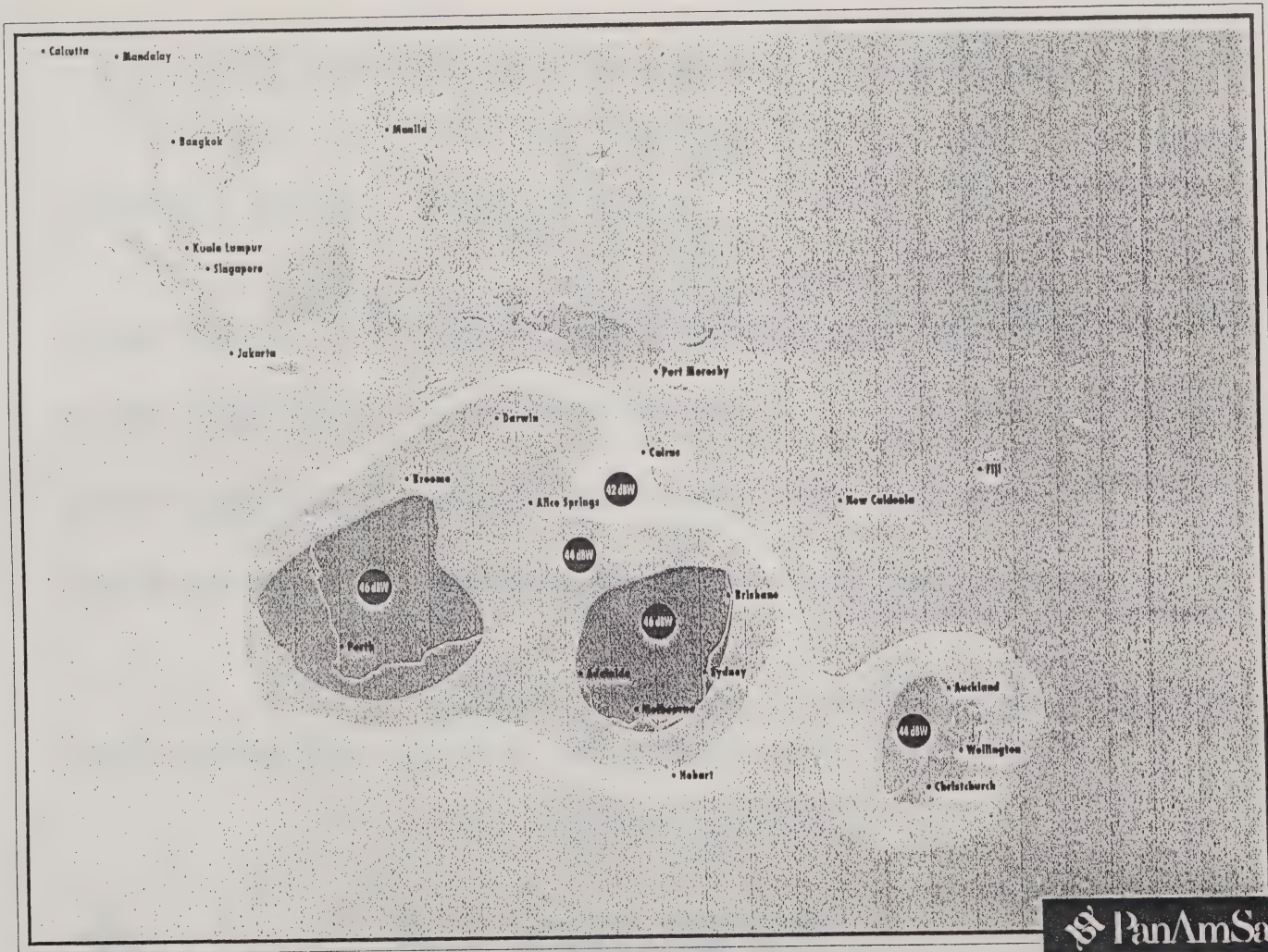


PAS-2 North East Asia Beam • Ku-Band



PanAmSat

PAS-2 China Beam • Ku-Band



PanAmSat

PAS-2 Australia/New Zealand Beam • Ku-Band

PANAMSAT

General Satellite Information

Orbital Locations:	PAS-2	191 degrees W.L.	(POR Primary)
	PAS-3	43 degrees W.L.	(AOR Follow-On)
	PAS-4	72 degrees E.L.	(IOR Primary)
Orbital Control:	+/- 0.05 degrees Inclination and Longitude		
Spacecraft Type:	Hughes 601 series, 3-axis stabilized		
Design Lifetime:	15 years		
Transponders :	16 54/64 MHz C-Band 34 Watt SSPA's		
	16 54/64 MHz Ku-Band 63 Watt TWTA's		
Frequency Bands:	C-Band	Uplink	5.9 - 6.4 GHz
		Downlink	3.7 - 4.2 GHz
	Ku-Band	Uplink	14.0 - 14.5 GHz
		Downlink	11.7 - 12.2 GHz or
			12.2 - 12.7 GHz

PanAmSat

C-Band Payload Information

Number of Transponders:	16 with 4 spares
Transponder Bandwidth:	12 - 54 MHz 4 - 64 MHz 6 MHz Guard Band
Polarization:	Linear - Horizontal and Vertical
SFD (Beam Center) :	-99 dBW/m2
Input Attenuators:	0 to 15 dB in 1 dB steps
G/T:	-1.0 to -9.0 dB/K
EIRP:	32 to 38 dBW
Beacon Frequencies:	4.1985 and 4.1995 GHz (0 dBW) Horizontally Polarized

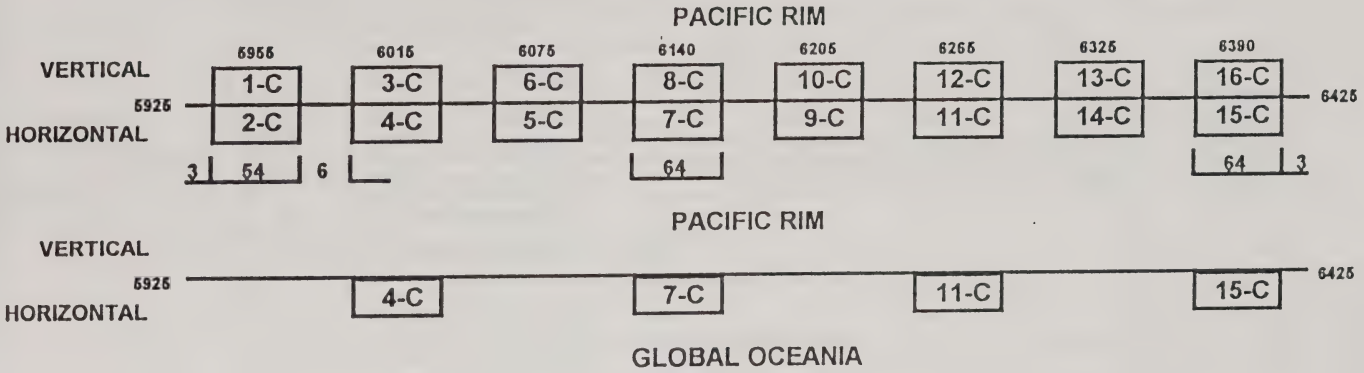
PanAmSat

Ku-Band Payload Information

Number of Transponders:	16 with 4 spares
Transponder Bandwidth:	12 - 54 MHz 4 - 64 MHz 6 MHz Guard Band
Polarization:	Linear - Horizontal and Vertical
SFD (Beam Center) :	-90 dBW/m2
Input Attenuators:	0 to 15 dB in 1 dB steps
G/T:	+2.5 to -5.0 dB/K
EIRP:	44 to 52 dBW
Uplink Power Control (UPC) Beacon Frequency:	12.50 GHz (5 dBW) RHCP and LHCP

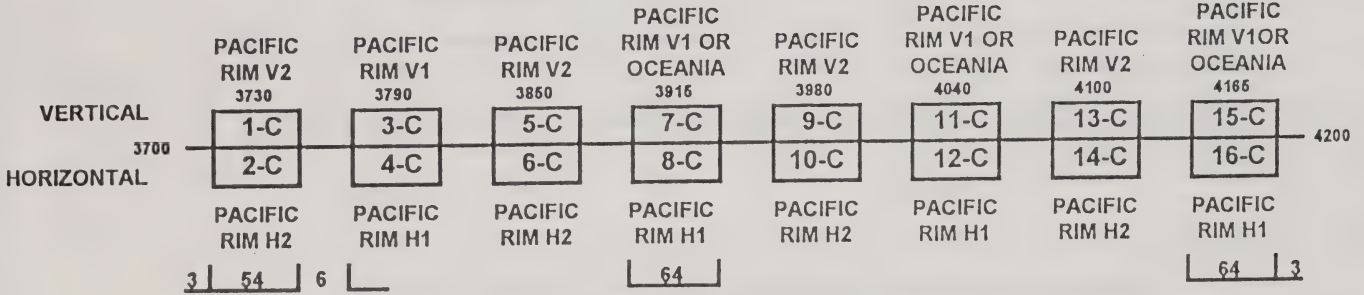
PANAMSAT

PAS-2 (POR) C-Band Frequency Plan



GLOBAL OCEANIA

UPLINK RECEIVE



DOWNLINK TRANSMIT

930920

PANAMSAT

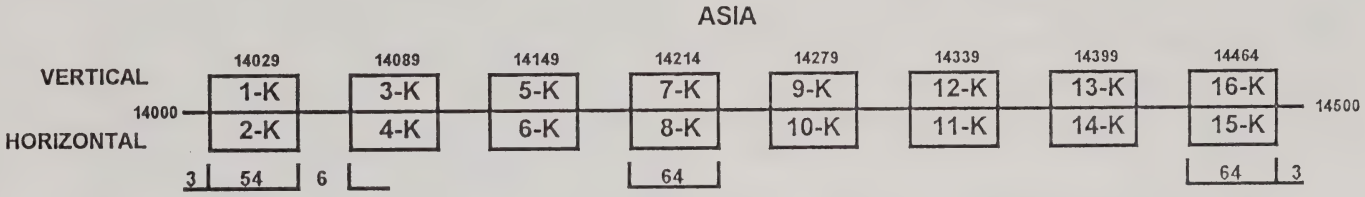
PAS-2 (POR) C-Band Interconnection Matrix

Downlink			Uplink				
Channel	Pol	Coverage	C-Band Vert Pacific Rim	C-Band Horiz Pacific Rim	C-Band Horiz Oceania	Ku-Band Vert Asia	Ku-Band Horiz Asia/Australia
1-C	V	Pacific Rim Beam V2	1-C				10-K
3-C	V	Pacific Rim Beam V1	3-C			12-K	
5-C	V	Pacific Rim Beam V2		5-C		13-K	
7-C	V	Pacific Rim Beam V1 or Oceania		7-C	7-C		15-K
9-C	V	Pacific Rim Beam V2		9-C			
11-C	V	Pacific Rim Beam V1 or Oceania		11-C	11-C		
13-C	V	Pacific Rim Beam V2	13-C				
15-C	V	Pacific Rim Beam V1 or Oceania		15-C	15-C		
2-C	H	Pacific Rim Beam H2		2-C		9-K	
4-C	H	Pacific Rim Beam H1		4-C	4-C		11-K
6-C	H	Pacific Rim Beam H2	6-C				14-K
8-C	H	Pacific Rim Beam H1	8-C			16-K	
10-C	H	Pacific Rim Beam H2	10-C				
12-C	H	Pacific Rim Beam H1	12-C				
14-C	H	Pacific Rim Beam H2		14-C			
16-C	H	Pacific Rim Beam H1	16-C				

930920

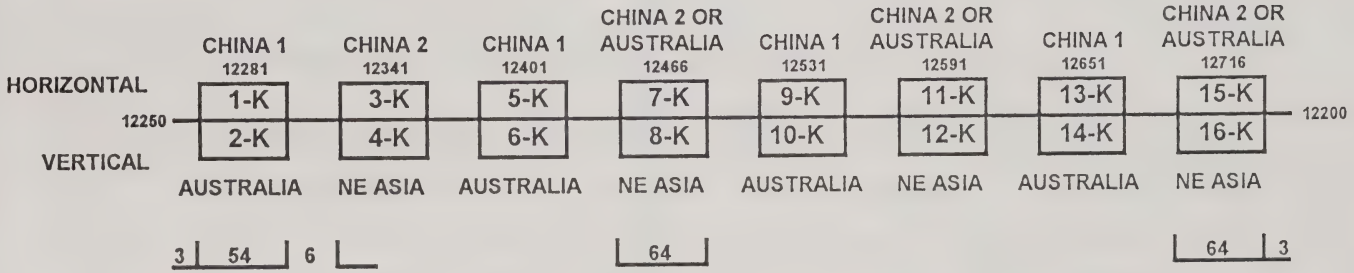
PANAMSAT

PAS-2 (POR) Ku-Band Frequency Plan



ASIA/AUSTRALIA

UPLINK RECEIVE



DOWNLINK TRANSMIT

930920

PANAMSAT

PAS-2 (POR) Ku-Band Interconnection Matrix

Downlink			Uplink				
Channel	Pol	Coverage	Ku-Band Vert Asia	Ku-Band Horiz Asia/Australia	C-Band Vert Pacific Rim	C-Band Horiz Pacific Rim	C-Band Horiz Oceania
1-Ku	H	China Beam 1	1-K				
3-Ku	H	China Beam 2	3-K				
5-Ku	H	China Beam 1	5-K				
7-Ku	H	China 2 or Australia	7-K				
9-Ku	H	China Beam 1	9-K			2-C	
11-Ku	H	China 2 or Australia		11-K		4-C	
13-Ku	H	China Beam 1	13-K			5-C	
15-Ku	H	China 2 or Australia		15-K		7-C	
2-Ku	V	Australia		2-K			
4-Ku	V	Northeast Asia		4-K			
6-Ku	V	Australia		6-K			
8-Ku	V	Northeast Asia		8-K			
10-Ku	V	Australia		10-K	1-C		
12-Ku	V	Northeast Asia	12-K		3-C		
14-Ku	V	Australia		14-K	6-C		
16-Ku	V	Northeast Asia	16-K		8-C		

930920

FUTURE SATELLITE SYSTEMS FOR ASIA

by Mark Long

Although there are numerous domestic, regional, and international satellite operators who plan to launch new satellite systems for the Asia/Pacific region in the years ahead, there are only three systems which have been designed exclusively to serve Asia on a regional basis: Asiasat-2, Apstar and Palapa C. Asiasat-2 is widely regarded as a new spacecraft of major importance for the entire region because of the predominant position of Asiasat-1 at present and the reservation of multiple channels by STAR TV on the new satellite. Now that Asiasat has resolved its orbital dispute with Thaicom (see related story elsewhere in this issue) and secured the desirable position of 100.5 degrees East Longitude, plans for Asiasat-2 can proceed full steam ahead.

Apstar has also achieved notariety due to the commitment of major international programmers such as HBO, ESPN, and CNN for capacity on Apstar-1. Recent reports indicate that a major share of Apstar-2's capacity alsomay have been acquired by STAR TV for expanding its cable and direct-to-home delivery of TV programming. These reports also have speculated about the merger of Apstar and Asiasat to form a single powerful satellite consortium that could dominate the satellite scene in Asia for the foreseeable future.

Indonesia's forthcoming Palapa C system also should not be left out of consideration when discussing the future of satellite communications in Asia. Palapa C coverage beams have been expanded to permit the satellite systemto serve new markets which presently lie outside the reach of the current Palapa B system, including Australia, New Zealand, and the Pacific island of Guam. Indonesia's current system has attracted numerous regional and international customers and with Indonesian owner SATELINDO planning to permit outside participation in the ownership of the Palapa C system, many customers may find this alternative to be an irresistable one.

The following article presents an overview of the technical parameters of each system, providing a glimpse of Asian satellite communications well into the 21st century.

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The ASIASAT 2 Satellite

On October 26, 1992, AsiaSat announced a HK$ One Billion contract with Martin Marietta (MM) Astro - Space of Princeton, New Jersey, to build Asiasat's second generation satellite, AsiaSat 2. The contract award included satellite production and delivery of one commercial communications satellite in the fourth quarter of 1994, as well as launch services and an option to take delivery of an additional satellite twelve months later. The contract was awarded to Martin Marietta Astro - Space in the face of fierce competition from Hughes of the United States and Matra Marconi, a European consortium. In parallel with the Asiasat 2 contract to GE, AsiaSat has awarded a consultancy contract to Comsat Corporation—the U.S. Signatory to INTELSAT—to provide technical assistance to AsiaSat for the spacecraft, launch vehicle, and overall mission support.

The AsiaSat 2 spacecraft will use MM's Series 7000 satellite bus. The hybrid AsiaSat 2 satellite will provide twenty-four C-band transponders—twenty with a bandwidth of 36 MHz and four with a bandwidth of 72 MHz—and nine Ku-band transponders with a bandwidth of 54 MHz. The spacecraft, which will be designed to achieve a mission lifetime of fifteen years, will be compatible with a range of modern launch vehicles.

ASIASAT 2 At A Glance

Operational History	
Future Orbital Assignment:	100.5 degrees East
Launch date:	Early 1995
Launch Vehicle:	Chinese Long March 2E
Status:	Contract Awarded
Design Life:	Thirteen years
Maneuver Life:	Fifteen years
Communications Payload	
Frequency Bands:	Receive: 5.845~6.425 GHz Transmit: 3.620~4.200 GHz
Channels/Bandwidth:	C-band: 20 with 36 MHz BW 4 with 72 MHz BW Ku-band: 9 with a 54 MHz BW
C-band Antenna Coverage:	China, Japan, Indonesia, India, the Middle East, and the C.I.S. Republics
Ku-band Antenna Coverage:	Hong Kong, China, Taiwan, Korea
Signal Power (EIRP):	C-band: 42 dBW at beam center Ku-band: 53 dBW at beam center
TWTA Power:	C-band: 55 watts Ku-band: 115 watts
SFD:	C-band: -97 ±1 dBW/m^2 Ku-band: -97 ±1 dBW/m^2
Receiver G/T:	C-band: 0 dB/K maximum Ku-band: 6 dB/K maximum
Spacecraft	
Satellite Type:	Martin Marietta Astro - Space Series 7000 Three axis body stabilized
Mass At Launch:	3460 kg
Electrical Power:	1022 Watts at end of life
Command Frequencies:	6.4235 GHz Vertical
Telemetry Beacons:	4.1975, 4.1995 GHz Horizontal
Tracking Beacons:	12.503 GHz Vertical 12.504 GHz Horizontal

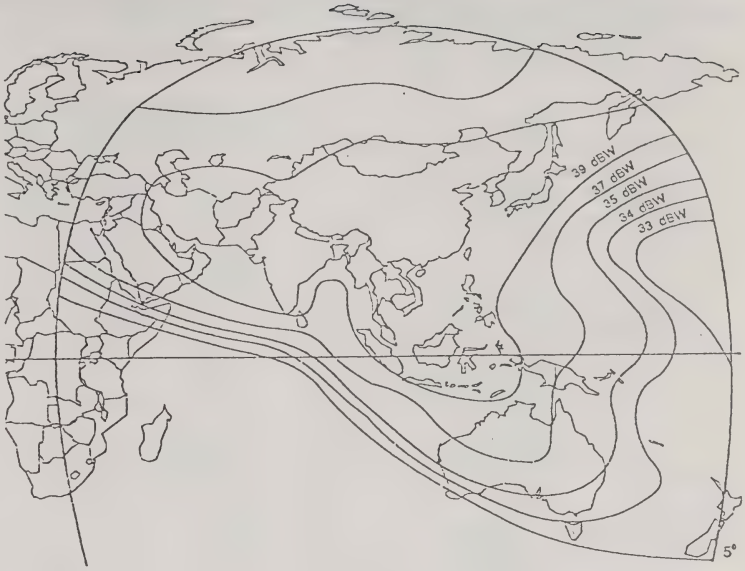
AsiaSat 2's proposed C-band footprint will stretch from Tokyo to Berlin and South to Jakarta, Indonesia and portions of Australia, as well as areas in between such as the Indian subcontinent, the Middle East, and Eastern Europe. This wide coverage area contains the homes for 72 percent of the world's population. High levels of EIRP will be maintained throughout this broad area through the use of 55-watt TWTAs.

Asiasat 2's proposed Ku-band footprint will include Hong Kong, China, Taiwan, and Korea. The use of high-powered, 115-watt TWTAs will permit the use of AsiaSat 2 for DBS operations within this coverage area.

"The launch of Asiasat 2 will support the growing de-

mand for the region, providing greater opportunities and benefits to the end users," said Terry Seddon, Chief Executive Officer of AsiaSat. "The procurement of AsiaSat 2 will consolidate our position as a major supplier of satellite capacities throughout the region, underlining our commitment, and, at the same time, providing us with a significant advantage over other competing satellite systems. Asiasat 2 will enable us to provide the most advanced satellite communications services with nothing less than superior quality."

In March of 1993, Asiasat signed a launch contract with China Great Wall Industry Corporation for the launch of Asiasat 2 using a Long March 2E launch vehicle. The launch is scheduled for the first quarter of 1995 fron China's Xichang launch site.



Asiasat 2 C-Band Coverage Beam

Asiasat 2 Ku-Band Coverage Beam

The APSTAR Satellite System

APT Satellite Company Ltd.
Room 1002, 10/F,
Conic Investment Building
13 Hok Yuen St.
Hunghom, Kowloon
Hong Kong
Mr. He Ke Rang, President
Mr. Bao Miao Qin, Chief Engineer
Tel: (852) 356-3290
Fax: (852) 773-1050

In April of 1992, Asia Pacific Telecommunications (APT) Satellite Company, Ltd. was registered in Hong Kong as an international company for engaging in communications. The sponsored shareholders include China Telecommunications & Broadcast Satellite Corporation, Hong Kong Chia Tai International Telecommunications Company, Ltd., China Yuan Wang Group Company, and Hong Kong-based Ever-Victory System Company, Ltd.

On May 25, 1992, a contract was signed between Hughes Communications International, Inc. and APT Satellite

Asiasat 2 100.5° East - C-Band
Satellite Power In Footprint Countries

Country	City	Azimuth (degree)	Elevation (degree)	EIRP dBW	G/T (dB/K)
Afghanistan	Kabul	133.1	37.4	39	-5
Australia	Sydney	114.36	23.8	35	-11
Bahrain	Bahrain	110.7	28.1	39	-3.5
Bangladesh	Dhaka	156.3	60.1	39	-3
Bhutan	Thimpu	157.6	55.7	39	-3
Brunei	Bandar Seri. B.	252.4	72.7	39	-3
Cambodia	Phnom Penh	201.0	75.5	39	-3
China	Beijing	203.3	41.0	39	-4
	Guangzhou	209.8	59.4	39	-2
	Kunming	184.7	60.6	39	-3
	Chengdu	187.1	54.5	39	-3
	Shanghai	216.3	47.3	39	-3
Cyprus	Nicosia	103.6	9.9	37	-6
Egypt	Cairo	100.6	9.1	37	-5
Hong Kong	Hong Kong	212.6	59.5	39	-2
India	Bangalore	118.8	59.1	39	-4
	Hyderbad	127.3	58.7	39	-4
	Bombay	126.9	55.9	39	-3
	Calcutta	150.5	60.3	39	-3
	Madras	121.4	61.9	39	-4
	New Delhi	138.2	48.4	39	-4
Indonesia	Jakarta	315.3	79.6	39	-6
	Medan	147.9	85.3	39	-3
Iran	Tehran	116.5	24.6	39	-5
Iraq	Baghdad	110.0	20.6	38	-5
Israel	Tel Aviv	103.3	11.6	38	-5
Japan	Tokyo	234.4	31.6	39	-3
Korea	Seoul	219.6	38.9	39	-3
Kuwait	Kuwait	110.7	24.6	39	-4
Laos	Vientiane	186.8	68.8	39	-4
Malaysia	Kuala Lumpur	196.5	86.2	39	-3
Mongolia	Ulaanbaatar	188.8	35.0	38	-8
Myanmar	Yangon	164.8	70.0	39	-3
N. Korea	Pyongyang	219.1	37.5	39	-3
Nepal	Kathmandu	147.5	51.6	39	-3
Oman	Muscat	110.3	36.7	39	-3
Pakistan	Islamabad	135.9	42.0	39	-5
Philippines	Manila	235.3	60.5		
Russia (CIS)	Moscow	112.7	16.2	37	-8
	Vladivostock	221.7	31.2	39	-4
Saudi Arabia	Riyadh	106.6	24.4	39	-4
Singapore	Singapore	255.3	85.4	39	-3
Syria	Damascus	104.9	12.8	38	-5
Taiwan	Taipei	223.0	52.2	39	-3
Thailand	Bangkok	180.0	73.5	39	-2
Turkey	Ankara	104.4	8.2	38	-6
U.A.E.	Abu Dhabi	111.4	31.8	39	-4
Vietnam	Hanoi	193.7	64.7	39	-2
	Ho Chi Minh City	209.7	75.9	39	-2

Company Ltd. of Hong Kong for the provision of two spacecraft which will provide satellite communications services on behalf of the company's customers in North and Southeast Asia. The contract calls for one spacecraft with an option for an additional satellite at a later date, launch and mission support services, a satellite control facility, and training. The first APSTAR is scheduled for launch in 1994.

Apstar 1 (to be located at 131 degrees East Longitude) will be based on the Hughes' spin-stabilized HS 376 platform. Apstar 1 will provide 24 medium-power C-band transponders, 20 with a bandwidth of 36 MHz and four with a bandwidth of 72 MHz, downlinking within the 3.6 to 4.2 GHz frequency range. The 36-MHz transponders will be most suitable for the transmission of TV signals, while the 72 MHz transponders will be capable of supporting VSAT systems or 120 Mb/s TDMA voice and data communications traffic.

Apstar 1 will have a wide coverage beam that will illuminate all of Bangladesh, China, Japan, Korea, Mongolia, and Southeast Asia with a nominal 34 to 35 dBW of EIRP, and portions of India and the C.I.S. with a nominal EIRP of 30 to 34 dBW. This single broad coverage beam will be favorable to the direct establishment of regional communications services, both for TV broadcasting and domestic voice and data networks. The spacecraft is expected to have a minimum

oribital lifetime of ten years.

Apstar-1 is scheduled for a July, 1994 launch. The initial system will include a TTC&M station to be built in the Hong Kong/Macau region.

Apstar-2 (134 degrees East Longitude) will have a similar capacity with geographical coverage and payload complement yet to be determined. Apstar-2 will provide 18 C-band transponders and 4 Ku-band transponders. Apstar-2 is tentatively scheduled for launch in June of 1995.

The Palapa C Satellite System

In 1995, Indonesia will begin replacing its existing Palapa B satellites with a new third generation satellite system known as Palapa C. The first satellite is scheduled to be launched in June of 1995 to replace Palapa B2P.

Facing increasing competition from several other international and regional systems, Indonesia has decided to increase the power output and range of the primary C-band beam for Palapa C to significantly improve coverage in eastern Australia, Cambodia, Hong Kong, Macau, Myanmar, New Zealand, and Vietnam. This beam will be connected to as many as 24 transponders.

An extended C-band beam also will be provided to provide coverage into Bangladesh, areas of China, India, Japan, Korea, Siberia (Russia), Sri Lanka, and Taiwan. The extended beam will be connected to as many as six transponders.

APSTAR-1 At A Glance

Operational History	
Future Orbital Assignment:	131 degrees East
Launch date:	June, 1994
Launch Vehicle:	Chinese Long March II
Status:	Under construction
Design Life:	Ten years
Communications Payload	
Frequency Bands:	Receive: 5.845~6.425 GHz Transmit: 3.620~4.200 GHz
Channels:	12 with Horizontal & 12 with Vertical Polarization
Channel Bandwidth:	36 MHz for 20 transponders 72 MHz for 4 transponders
Antenna Coverage:	North and Southeast Asia
Signal Power (EIRP):	35 dBW nominal within service area
TWTA Power:	16 watts
G/T:	More than - 4 dB/K at beam edge
SFD:	-78.0 ~ -88.0 dBW/m² at beam edge
Redundancy:	30 for 24 (power amplifiers) 4 for 2 (receivers)
Spacecraft	
Satellite Type:	Hughes HS-376 spin stabilized
Mass:	1383 kg
Electrical Power:	1022 Watts at end of life
Telemetry Beacon:	4.199375 or 4.199575 GHz
Command:	6.422 GHz (Uplink) 5.928 GHz (Transfer orbit)

APSTAR 1 EIRP & G/T At Major Cities

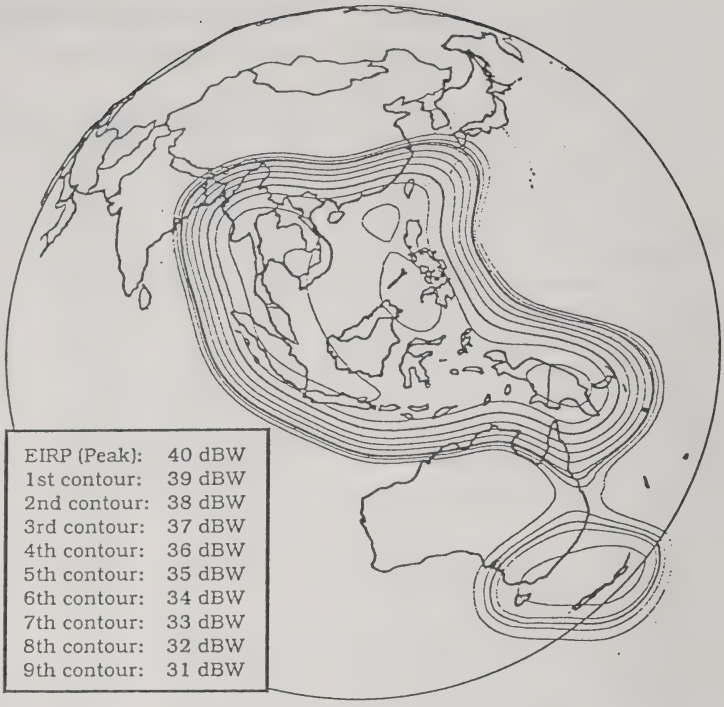
City	EIRP (dBW)	G/T (dB/K)
Guang Zhou	35.8	-3.2
Wu Han	35.9	-3.1
Lan Zhou	35.6	-2.8
Kun Ming	35.8	-1.1
Bei Jing	36.1	-2.8
Har Bing	35.3	-2.8
Taipei	36.5	-2.5
Hong Kong	36.0	-3.3
Shang Hai	36.9	-3.1
Rangoon	35.5	-2.0
Bangkok	36.1	-2.4
Singapore	35.1	-1.6
Manila	35.9	-1.6
Jakarta	33.9	-1.6
Seoul	36.4	-3.4
Ulan Bator	34.3	-2.2
Urumqi	34.5	-3.1

For the first time, Palapa satellites also will be equipped with Ku-band capacity. The Palapa C Ku-band beam will cover Guam, Hong Kong, Japan, Macau, Singapore, Malaysia, Taiwan, and Thailand. The Ku-band beam will be connected to a total of 4 transponders, each with a bandwidth of 72 MHz.

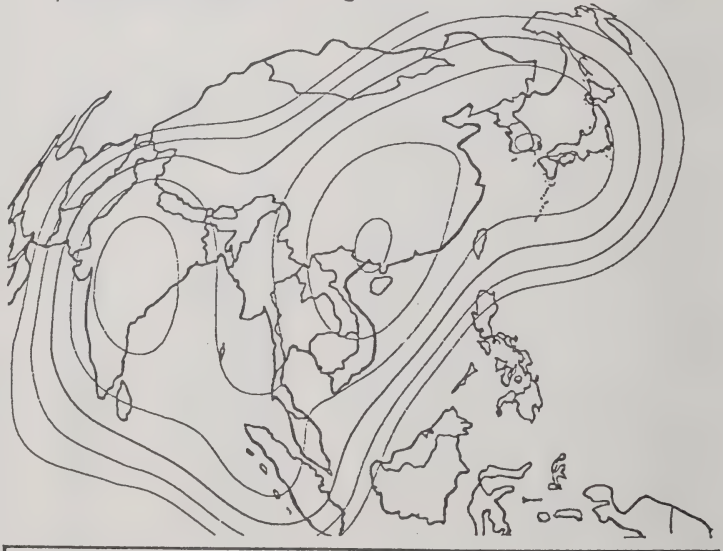
Hughes Aircraft Company has signed an agreement to build two Palapa C communications satellites for Indonesia. The multimillion-dollar contract is between Hughes Communications International, Inc., of Los Angeles—a Hughes Aircraft subsidiary—and PT SATELINDO, the newly formed, private telecommunications company in Indonesia. Financial details were not disclosed. The agreement calls for two HS 601 model body-stabilized satellites, plus an option for a third spacecraft. Hughes also will upgrade the master control station in Daan Mogot, outside Jakarta.The Palapa-C satellites are scheduled for delivery in July, 1995, and January, 1996. SATELINDO has until 1999 to exercise its option for the third satellite.

The launch contract for Indonesia's Palapa C1 satellite was signed by Mr. Iwa Sewaka, Chairman of P.T. Satelit Palapa Indonesia (Satelindo), Mr. Adi R. Adiwoso, Chairman of P.T. Pasifik Satelit Nusantara (BSN) of Indonesia, and Mr. Charles Bigot, Chairman and CEO of Arianespace.

Palapa C1 will be launched in 1995 by an Ariane launch vehicle from the Kourou Space


EIRP (Peak): 40 dBW
1st contour: 39 dBW
2nd contour: 38 dBW
3rd contour: 37 dBW
4th contour: 36 dBW
5th contour: 35 dBW
6th contour: 34 dBW
7th contour: 33 dBW
8th contour: 32 dBW
9th contour: 31 dBW

Palapa C1 Extended Coverage Beam



Center in French Guiana. It will be built by Hughes Aircraft of the United States. Weighing 2,989 kilograms at launch, Palapa C1 will offer 30 C-band channels and 4 Ku-band channels, to provide both telephone and television transmission services. Design life in geostationary orbit is 14 years.

PALAPA C At A Glance

Operational History

Launch Date:	Palapa C1 - 1995 Palapa C2 - 1996
Launch Vehicle:	Ariane 4
Orbital Assignment:	C1 - 113 degrees East C2 - 108 degrees East
Mission Lifetime:	14 years

Communications Payload

Frequency Band(s):	Receive: 5.925~6.425 GHz Transmit: 3.700~4.200 GHz Receive: 6.425~6.665 GHz Transmit: 3.400~3.680 GHz Receive: 13.250~14.000 GHz Transmit: 10.950~11.700 GHz
C-band Channels:	30
C-band Channel Bandwidth:	36 MHz
Ku-band Channels	4
Ku-band Channel Bandwidth:	72 MHz
Channel Polarization:	Horizontal/Vertical Polarity
Standard C-band Coverage:	Indonesia, Malaysia, Thailand, Philippines, Singapore, Cambodia, Vietnam, Macau, Taiwan, Hong Kong, New Zealand, and eastern Australia.

Extended C-band Coverage:
Thailand, Malaysia, Taiwan, Myanmar, Sri Lanka, Bangladesh, India, Korea, Japan, and eastern China.

Ku-band Coverage:
Japan, Korea, Hong Kong, Taiwan, Malaysia, Thailand, Singapore, Macau, and Guam.

C-band Signal Power (in EIRP):
37 dBW nominal

C-band G/T:
-2.5 dB/K

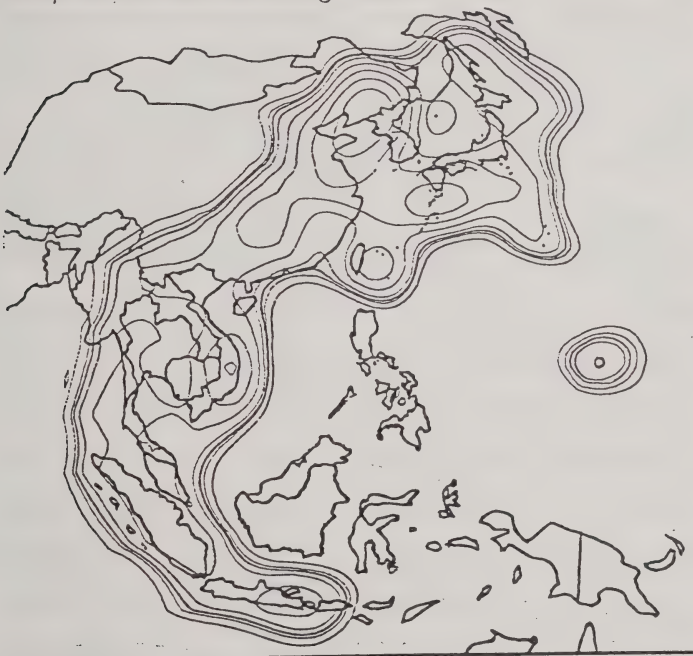
Ku-band Signal Power:
50 dBW

Ku-band G/T:
+4.0 dB/K

Spacecraft
Satellite Type: Hughes HS 601 three-axis stabilized

Mass in Orbit:
2,989 kilograms

Palapa C Ku-band Coverage Beam



EIRP (Peak):	50 dBW	5th contour:	45 dBW
1st contour:	49 dBW		
2nd contour:	48 dBW	Guam EIRP	
3rd contour:	47 dBW	1st contour:	48 dBW
4th contour:	46 dBW	4th contour:	45 dBW

SPECIAL REPORT:

The Arabsat Regional Satellite System

by Mark Long

The Arabian Satellite Telecommunications Organization (Arabsat) is a regional satellite system created under the auspices of the 22 members of the League of Arab States, an international cooperative composed of the following countries and entities: Algeria, Bahrain, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, the Palestine Liberation Organization (PLO), Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, Yemen Arab Republic, People's Democratic Republic of Yemen, and the United Arab Emirates. In 1976 the Arab League formed the Arabian Satellite Communications Organization (Arabsat) to supervise the construction, launch, and operation of the Pan-Arabian satellite system.

In 1981, Arabsat chose Aerospatiale as the prime contractor for the development and production of its first generation satellites, with U.S. corporations Ford Aerospace (today known as Space Systems/Loral) and McDonnell Douglas Corporation also providing substantial assistance for the project.

Arabsat 1-A was deployed by Ariane on February 8, 1985 and Arabsat 1-B was launched from a NASA space shuttle on June 18, 1985. Both of these satellites have since been retired from service.

Arabsat 1-C was launched by Arianespace on February 26, 1992. In 1993, Arabsat purchased an older, in-orbit satellite from Telesat Canada. This satellite is now known as Arabsat 1-D.

On April 17, 1993, Arabsat signed a contract with Aerospatiale for the construction of two next-generation Arabsat II satellites. Arabsat II series satellites will feature an expanded C-band coverage beam, higher C-band transponder power, and a Ku-band satellite communications payload. The first flight model of the Arabsat II series will be ready for launch by Arianespace in 1995.

Arabsat 1-C

The Arabsat 1-C telecommunications payload operates in both the C- and S-bands. Twenty-five C-band transponders are available from the spacecraft. Each of the two S-band (2.5~2.6 GHz) transponders aboard Arabsat 1-C is powered by two 50 watt TWTAs in parallel. This capacity was designed to provide a DBS television signal to community earth stations at locations with little or no access to terrestrial television broadcasts. Antennas 12 feet (3.5m) in diameter can be used for reception of S-band transmissions once they have been implemented.

Communications Traffic

Arabsat 1-C telecommunications traffic consists of analog and digital telephony, high-speed data relays, regional TV distribution of news and other programming to members of the Arab States Broadcasting Union (ASBU), regional distribution of program services such as Middle East Broadcasting Center (MBC), CNN International (USA), and Canal Plus International (France), distribution of national TV services for Abu Dhabi, Dubai, Egypt, Jordan, Kuwait, Oman, Mauritania, Morocco, and Saudi Arabia, distribution of the Radio Sudan and Radio Orient radio services, and community TV reception of MBC through the satellite's S-band payload. A recent transponder report covering TV and Radio services carried by the satellite is provided on page 10 of this issue.

Moreover, the Middle East Broadcasting Centre (MBC) intends to launch a package of digitally compressed subscription channels over Arabsat beginning in 1994. The new channels are: MBC2 - the Movie Channel; MBC3 - the Family, Entertainment and Educational Channel; MBC4 - the General Entertainment Channel; and a News/Sports channel. MBC will be using the DigiCipher digital video compression system developed by General Instrument.

Arabsat 1-C TV and Radio Services as of December 1, 1993

ARABSAT I-C - 31° EAST

Sat.	Orbit	Tr.	Beam	Pol/Freq.	BW	Service	Subcarrier	EIRP
Abs I-C	31.0 E	1A	Z	V-2.634	32	**MBC**	6.6 MHz	43 dBW
Abs I-C	31.0 E	4	Z	RH-3.771	0.5	**Radio Sudan**	SCPC	33 dBW
Abs I-C	31.0 E	5	Z	LH-3.811	32	**Canal Plus Int.** [Fr.]	6.6 MHz	33 dBW
Abs I-C	31.0 E	7	Z	RH-3.82975	32	**CNN International**	6.6 MHz	33 dBW
Abs I-C	31.0 E	8	Z	LH-3.835	0.3	**Radio Orient**	SCPC	33 dBW
Abs I-C	31.0 E	9	Z	RH-3.866	32	**Occ. Video - ABSU**	6.65 MHz	33 dBW
Abs I-C	31.0 E	14	Z	LH-395925	32	**Dubai TV [UAE]**	6.60 MHz	33 dBW
Abs I-C	31.0 E	15	Z	RH-3.97775	32	**Saudi 1** [Arabic]	6.65 MHz	33 dBW
Abs I-C	31.0 E	17	Z	RH-4.008	18	**RTM-1 Morocco TV**	6.65 MHz	31 dBW
Abs I-C	31.0 E	18	Z	LH-4.03325	32	**Abu Dhabi TV [UAE]**	6.60 MHz	33 dBW
Abs I-C	31.0 E	19	Z	RH-4.05175	32	**Saudi 2** [English]	6.65 MHz	33 dBW
Abs I-C	31.0 E	20	Z	LH-4.062	18	**Oman TV**	6.60 MHz	31 dBW
Abs I-C	31.0 E	21	Z	RH-4.081	32	**TV Mauritania**	6.60 MHz	33 dBW
Abs I-C	31.0 E	22	Z	LH-4.10725	32	**MBC**	6.60 MHz	33 dBW
Abs I-C	31.0 E	23	Z	RH-4.12575	32	**Arab League TV**	6.60 MHz	33 dBW
Abs I-C	31.0 E	24	Z	LH-4.144	32	**JRT TV Jordan**	6.60 MHz	33 dBW
Abs I-C	31.0 E	25	Z	RH-4.16275	32	**TV Egypt**	6.60 MHz	33 dBW
Abs I-C	31.0 E	26	Z	LH-4.181	32	**KSC Kuwait**	6.60 MHz	33 dBW
						Radio Kuwait	5.8 MHz	

Arabsat 1-C C-band Coverage from 31 degrees East

Peak EIRP:	35 dBW
1st contour:	33 dBW
2nd contour:	31 dBW
3rd contour:	29 dBW
4th contour:	27 dBW
5th contour:	17 dBW

Arabsat 1-C S-band Coverage from 31 degrees East

1st contour:	41 dBW
2nd contour:	40 dBW
3rd contour:	39 dBW

Arabsat 1-C at a Glance

Operational History

Launch Date(s):	February 26, 1992
Launch Vehicle(s):	Arianespace
Orbital Assignment:	31 degrees East Longitude
Status:	Operational
Design Life:	7 years

Communications Payload

Frequency Band(s):	Receive:	5.925~6.425 GHz
	Transmit:	3.700~4.200 GHz
		2.540~2.655 GHz
Channels:	26:	12 C-band channels with RHCP, 13 C-band channels with LHCP, 1 S-band channel with H or V polarization
Channel Bandwidth:	33 MHz	
Antenna Coverage:	Arab League Nations	
Signal Power (EIRP):	C-band:	31 dBW nominal
	S-band:	41 dBW at beam edge
TWTA Power:	C-band:	8.5 watts
	S-band:	Two parallel 50-watt tubes
Capacity:	8,000 simultaneous telephone circuits & seven TV signals or equivalent traffic in other configurations	

Spacecraft

Satellite Type:	Space Systems/Loral (Ford Aerospace) three-axis stabilized
Mass in Orbit:	588 kg (1296.3 lbs)
Maximum (deployed) Dimensions:	2.26m (7.4 ft) x 1.64m (5.4 ft) x 1.49m (4.9 ft); 20.7m (67.9 ft) from tip to tip with solar arrays deployed
Electrical Power:	1,300 watts at end of life
Telemetry Beacons:	3.700~3.705 GHz 4.199 GHz

Arabsat 1-C Satellite Transponder Frequency Plan

Tr.	Pol.	Uplink/Downlink
1A	LP	5943.75/2560.50 MHz
1B	LP	5943.75/2634.50 MHz
2	LHCP	5962.25/3737.25 MHz
3	RHCP	5980.75/3755.75 MHz
4	LHCP	5999.25/3774.25 MHz
5	RHCP	6017.75/3792.75 MHz
6	LHCP	6036.25/3811.25 MHz
7	RHCP	6054.75/3829.75 MHz
8	LHCP	6073.25/3848.25 MHz
9	RHCP	6091.75/3866.75 MHz
10	LHCP	6110.25/3885.25 MHz
11	RHCP	6128.75/3903.75 MHz
12	LHCP	6141.25/3922.25 MHz
13	RHCP	6165.75/3940.75 MHz
14	LHCP	6184.25/3959.25 MHz
15	RHCP	6202.75/3977.75 MHz
16	LHCP	6221.25/3996.25 MHz
17	RHCP	6239.75/4014.75 MHz
18	LHCP	6258.25/4033.25 MHz
19	RHCP	6276.75/4051.75 MHz
20	LHCP	6296.25/4070.75 MHz
21	RHCP	6313.75/4088.75 MHz
22	LHCP	6332.25/4107.25 MHz
23	RHCP	6350.75/4125.75 MHz
24	LHCP	6369.25/4144.25 MHz
25	RHCP	6387.75/4162.75 MHz
26	LHCP	6406.25/4181.25 MHz

LP = Linear polarization
LHCP = Left hand circular polarization
RHCP = Right hand circular polarization

MBC will offer its pay TV channels either as a package or individually with a minimum of three channels being sold. MBC 1 will remain a free channel available to all viewers.

Arabsat 1-D

In 1993, the Arabsat organization signed an agreement with Telesat Canada governing the sale of the Anik D2 C-band communications satellite. Anik D2 was initially designed to serve as part of Canada's domestic satellite system. Most recently, however, the satellite was used by GE Americom to replace the ailing Satcom F4R satellite in December of 1991. With the successful launch of its new generation Satcom C3 and C4 satellites, GE no longer required the use of Anik D2. Control of the spacecraft was returned to Telesat Canada on April 1, 1993. Telesat subsequently drifted the satellite to a new orbital assignment at 20 degrees East Longitude. Renamed Arabsat 1-D, the satellite arrived on station in August of 1993. Following a comprehensive technical check-out by Arabsat and Telesat, the satellite was placed into operational service.

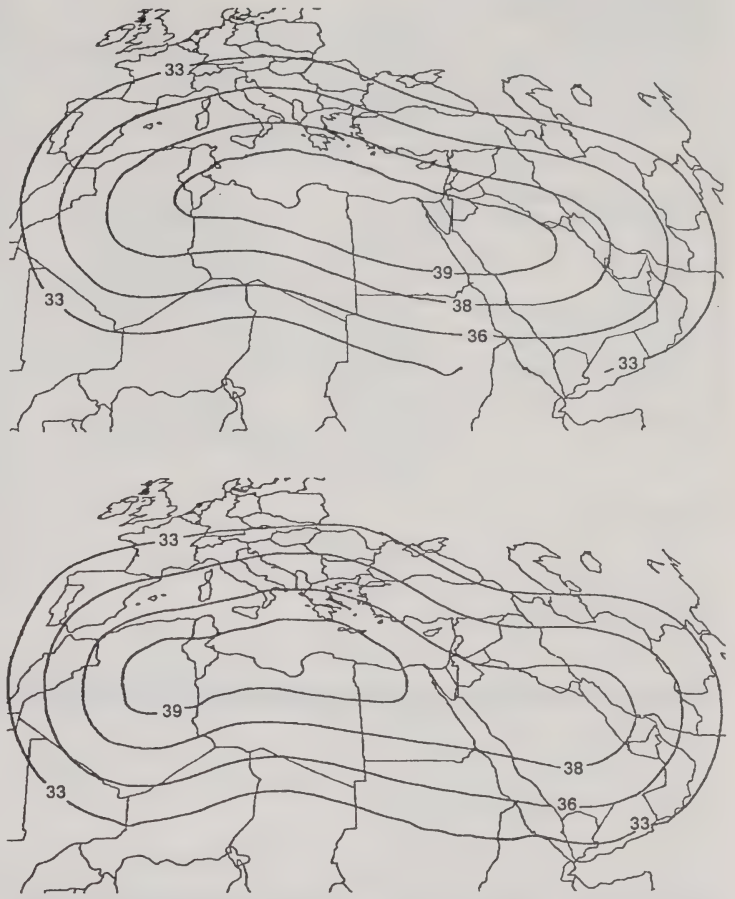
Because of low reserves of stationkeeping fuel, Arabsat

1-D was slowly drifted to its new orbital assignment to conserve precious fuel. Moreover, the satellite began operations in an inclined orbit mode from day one at its new assigned position. According to NASA's Satellite Situation Report of September 3, 1993, Arabsat 1-D's orbital inclination at that time was ±0.45 degrees. The inclination will increase at a rate of approximately ±0.8 degrees per year. Telesat expects that the satellite will remain functional through the end of 1995—long enough for Arabsat to launch the first of its next generation Arabsat II dual-band (C/Ku-band) spacecraft.

Telesat's contract with Arabsat includes Telesat's supply of telemetry, telecommunications, and command (TT&C) services. While the TT&C facility is physically based in Tunis, Telesat maintains direct control through computer links to Telesat's control center in Toronto, Canada.

Arabsat was forced to take this interim measure because of the premature loss of fuel experienced by its Arabsat 1-A and 1-B satellites which occurred in 1992—even though the use of a fuel saving inclined orbit was supposed to extend the operational lifetimes of the two satellites for several additional years. By allowing Telesat Canada to maintain control of the spacecraft, Arabsat has ensured that the satellite will be maintained by a knowledgable technical staff with plenty of experience in flying spin-stabilized spacecraft.

Arabsat 1-D Horizontal (top) and Vertical (bottom) Transponder Coverage Beams



Communications Traffic

Arabsat 1-D provides supplemental capacity for Arabsat 1-C which, at the time of writing, was fully loaded with television and telephony traffic.

In late 1993, a new service uplinked from Tunis known as Future TV made its appearance on Arabsat 1-D (3.800 GHz, 6.8 MHz audio subcarrier). The new Arabic-language service offers a wide variety of English-language programming with Arabic subtitles, including regular segments devoted to U.S. mini-series and music videos.

According to reports eminating from the 1993 MIPCOM convention, Rome-based Orbit Satellite Televi-

Arabsat 1-D at a Glance

Operational History

Launch Date(s):	November 9, 1984
Launch Vehicle(s):	McDonnell Douglas Delta 3920 rocket
Orbital Assignment:	20 degrees East Longitude
Status:	Operational
Design Life:	10 years (extended through use of two year storage orbit).

Communications Payload

Frequency Band(s):	Receive: 5.925~6.425 GHz Transmit: 3.700~4.200 GHz
Channels:	24: 12 with vertical polarization 12 with horizontal polarization
Channel Bandwidth:	36 MHz
Antenna Coverage:	Arab League Nations
Signal Power (EIRP):	33 dBW nominal
TWTA Power:	11.5 watts
Capacity:	21,600 one-way telephone circuits or 24 simultaneous color TV signals or equivalent traffic

Spacecraft

Satellite Type:	Spar Aerospace built Hughes HS-376 spin stabilized
Mass in Orbit:	632.8 kg (1395 lbs)
Maximum (deployed) Dimensions:	6.6m (12.75ft) x 2.2m (7.08 ft)
Electrical Power:	1,000 watts at end of life

Arabsat 1-D Future Programmers' Transponder Assignments

Future Vision:

Tr. 1	H	3.720 MHz
Tr. 4	V	3.800 MHz
Tr. 6	V	3.880 MHz

ART - Europlus

Tr. 3	H	3.760 MHz
Tr. 7	H	3.840 MHz
Tr. 11	H	3.920 MHz
Tr. 15	H	4.000 MHz

Orbit Satellite TV†

Tr. 17	H	4.040 MHz
Tr. 19	H	4.080 MHz
Tr. 21	H	4.120 MHz

Saudi Info

Tr. 14	V	3.980 MHz
Tr. 23	H	4.160 MHz

† Will use Digital Video Compression transmission system.

sion Network intends to launch a three-channel Arabic-language program package on the Arabsat 1-D satellite in early 1994, with the programming package growing to a total of 21 services by the end of the year. A recent news report in World Broadcasting magazine indicated that Orbit Satellite Television Network will use an MPEG 2.0 digital video compression system developed by Scientific Atlanta. The signals reportedly will be uplinked from Rome, Italy. Also in the wings: another new venture backed by direct-to-home satellite TV (INTELSAT K) programmer Europlus intends to use Arabsat 1-D to launch a four-channel service called Arab Radio & Television (ART).

Arabsat II

Arabsat II is the second generation of satellites developed for the Arab Satellite Communications Organization. Aerospatiale Espace & Defence was selected as prime contractor after an international tender, and signed the contract with Arabsat on April 17, 1993. Two flight models will be built, one of which will be delivered in orbit. The second is a ground spare. The first flight model will take over from the first generation Arabsat 1-C satellite, which also was built by Aerospatiale. As prime contractor, Aerospatiale is responsible for ensuring program management, and integration and testing of the spacecraft at its Cannes, France Center. Aerospatiale also is responsible for the structure, thermal control and solar arrays. Other team members are DASA (Germany) for the propulsion and attitude control, and Alcatel Espace (France) for the payload. Arianespace (France) is responsible for the launch, and CNES for the orbital positioning maneuvers.

The Arabsat satellites serve the entire region of the 21 Arab League countries. The satellites of the second gen-

Arabsat II at a Glance

Operational History		
Launch Date(s):	Mid-1995	
Launch Provider:	Arianespace	
Orbital Assignment:	26 degrees East Longitude	
Status:	Under construction	
Design Life:	16 years	
Communications Payload		
Frequency Band(s):	Receive:	5.925~6.425 GHz
		13.75~14.00 GHz
	Transmit:	3.700~4.200 GHz
		12.50~12.75 GHz
Channels:	11 C-band channels with RHCP	
	11 C-band channels with LHCP	
	6 Ku-band channels with "X" polarization	
	6 Ku-band channels with "Y" polarization	
Channel Bandwidth:	20 C-band Transponders 36 MHz wide	
	2 C-band Transponders 54 MHz wide	
	8 Ku-band Transponders 36 MHz wide	
	4 Ku-band Transponders 30 Mhz wide	
Antenna Coverage:	Arab League Nations	
Signal Power (EIRP):	High Powered C-band: 41 dBW	
	Regular C-band: 35 dBW	
	Ku-band: 47 dBW	
TWTA Power:	C-band: 13 & 52 watts	
	Ku-band: 90 watts	
Spacecraft		
Satellite Type:	Aerospatiale Spacebus 3000 three-axis stabilized spacecraft	
Launch Weight:	2,500 kg	
Payload Mass:	260 kg	
Dimensions:	1.8 x 2.3 x 2.3 meters	
Solar Array Span:	25 meters from tip to tip with solar arrays deployed	
Antenna Height:	7 meters	
Electrical Power:	5,000 watts at end of life	
Telemetry Beacons:	3.7011 GHz	
	4.1999 GHz	
Command Beacons:	5.9255 GHz	

eration have much higher performance than that of the first generation, and will have a lifetime extended to 16 years. They will provide services of telecommunications and direct television broadcasting by means of 22 C-band transponders and 12 Ku-band transponders. For the C-band payload, there will be 14 transponders (12 at 36 MHz and 2 at 54 MHz bandwidth) with 13-watt amplifiers capable of delivering an EIRP of 35 dBW, and 8 transponders (36 MHz bandwidth) with 52-watt TWTAs supplying an EIRP of 41 dBW. For the Ku-band payload, there will be 12 high-powered Ku-band transponders (8 at 36 MHz and 4 at 30 MHz bandwidth) with 90-watt TWTAs producing an EIRP of 47 dBW over the major portion of the satellite's coverage area.

An examination of the computer predict footprint maps for Arabsat II reveals that the new satellite will feature greatly expanded C-band coverage beams which will allow future programmers to reach ground stations throughout north and central Africa, and all of western Europe and the Middle East via a single satellite transmission. This emulation of the Asiasat signal distribution concept should permit Arabsat to effectively compete with other regional systems planning on serving this part of the world. What's more, the high-powered Ku-band payload on Arabsat II also will give Arabsat the ability to offer DBS capabilities to its Arab League members at a fraction of the cost of building and launching national DBS satellites.

One noticeable absence from the plan for Arabsat II is an S-band communications payload. The lack of S-band capabilities means that current users who have installed S-band reception equipment in northern Africa and the Middle East will have to retrofit their earth station antennas for either C- or Ku-band reception once the Arabsat 1-C satellite is retired in 1999. Perhaps Arabsat has plans to procure and launch a follow-on satellite with an S-band payload prior to the end-of-life for Arabsat 1-C. This would be welcome news for both current owners of S-band systems as well as

Arabsat II Transponder Assignments

C-band Transponder Center Frequency Plan

Tr.	Pol	BW	U/L Frequency	D/L Frequency
01	RHCP	36	5945.25 MHz	3720.25 MHz
02	LHCP	36	5965.75 MHz	3740.75 MHz
03	RHCP	36	5986.25 MHz	3761.25 MHz
04	LHCP	36	6006.75 MHz	3781.75 MHz
05	RHCP	36	6027.25 MHz	3802.25 MHz
06	LHCP	36	6047.75 MHz	3822.75 MHz
07	RHCP	36	6058.25 MHz	3843.25 MHz
08	LHCP	36	6080.75 MHz	3863.75 MHz
09	RHCP	36	6109.25 MHz	3884.25 MHz
10	LHCP	36	6129.75 MHz	3904.75 MHz
11	RHCP	36	6150.25 MHz	3925.25 MHz
12	LHCP	36	6170.25 MHz	3945.75 MHz
13	RHCP	54	6203.25 MHz	3978.25 MHz
14	LHCP	54	6223.75 MHz	3998.75 MHz
15	RHCP	36	6258.75 MHz	4043.75 MHz
16	LHCP	36	6282.50 MHz	4057.50 MHz
17	RHCP	36	6309.75 MHz	4084.75 MHz
18	LHCP	36	6323.50 MHz	4098.50 MHz
19	RHCP	36	6350.75 MHz	4125.75 MHz
20	LHCP	36	6364.50 MHz	4139.50 MHz
21	RHCP	36	6391.75 MHz	4166.75 MHz
22	LHCP	36	6405.50 MHz	4180.50 MHz

Ku-Band Transponder Center Frequency Plan

Tr.	Pol	BW	U/L Frequency	D/L Frequency
01	X	—	13768.0 MHz	12521.0 MHz
02	Y	—	13783.0 MHz	12535.0 MHz
03	X	—	13809.5 MHz	12552.5 MHz
04	Y	—	13824.8 MHz	12577.8 MHz
05	X	—	13851.5 MHz	12604.5 MHz
06	Y	—	13886.5 MHz	12619.5 MHz
07	X	—	13893.3 MHz	12646.3 MHz
08	Y	—	13908.3 MHz	12661.3 MHz
09	X	—	13932.1 MHz	12685.1 MHz
10	Y	—	13947.1 MHz	12700.1 MHz
11	X	—	13967.0 MHz	12720.0 MHz
12	Y	—	13982.0 MHz	12735.0 MHz

Note: As of April 17, 1993. Final frequency plan optimization may lead to slight channel center frequency adjustments.

equipment manufacturers who have made extensive commitment to the development of S-band products.

Arabsat II Spacecraft Bus

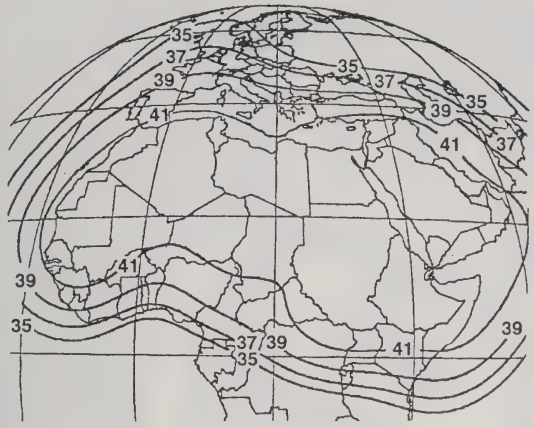
Arabsat II represents the first use of the new Spacebus 3000 platform, which has been developed by Aerospatiale and DASA. The three-axis stabilized Spacebus 3000 platform retains many of the features which have proven themselves in previous generations of the Spacebus platform series: central tube in graphite epoxy housing the propellant tanks, and a main body formed of two "U"-shaped structures, one being the communications module and the other the service module.

The unifed bi-propellant propulsion and attitude control system uses the same principle applied by the previous spacebuses, but has increased performance because of the use of platinum/rhodium for the manufacturing of the motors. New modular propellant tanks have been developed for the Spacebus 3000, which make it possible to optimize the mass. For Arabsat II, 1,546 kg of propellants will allow for a lifetime of 16 years.

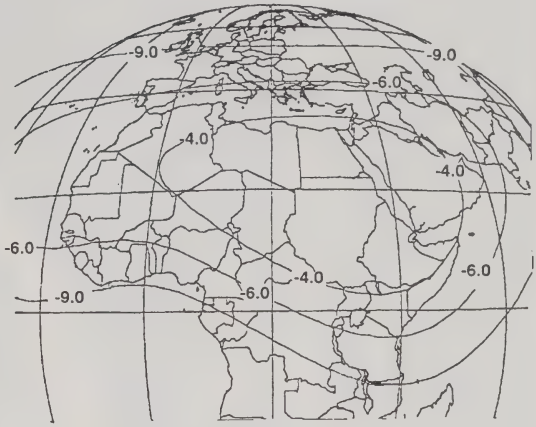
Among the innovations: an aluminium harness which reduces the weight of the wiring by almost 7 kg or 30 percent; a 42-volt regulated bus; and a dual gridded formed reflector for the Ku-band antenna.

ARABSAT II SATELLITE COVERAGE BEAMS

Arabsat II High Power
C-band Downlink Beam



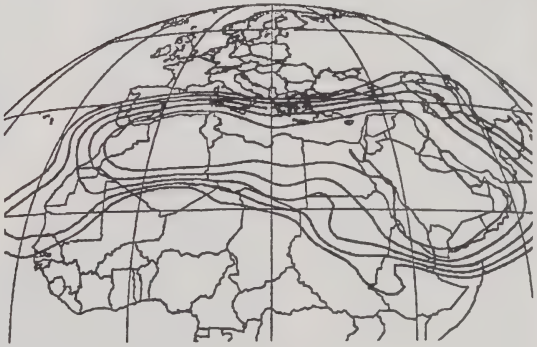
Arabsat II G/T
C-band Uplink Beam



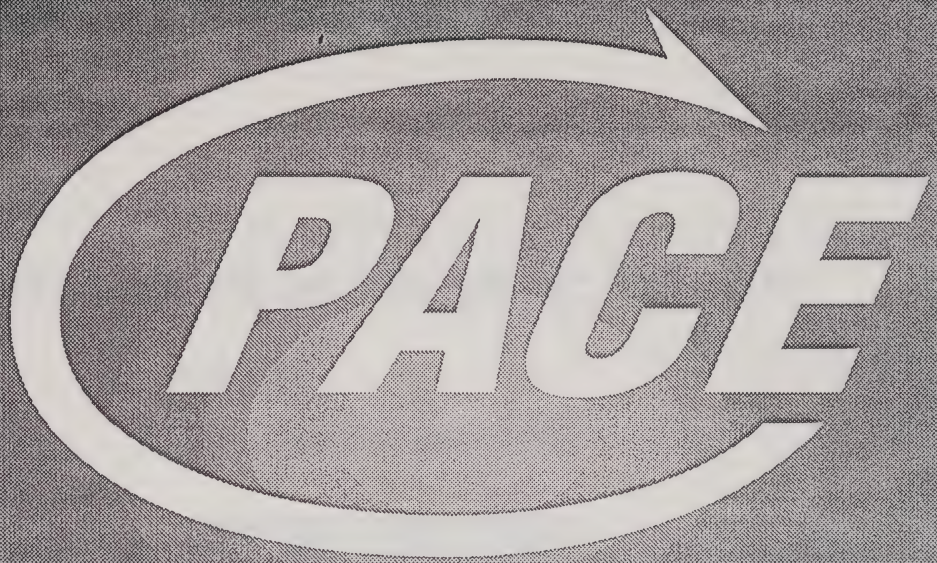
Arabsat II High Power
Ku-band Downlink Beam

1st contour:	47 dBW
2nd contour:	45 dBW
3rd contour:	43 dBW
4th contour:	41 dBW

Arabsat II G/T
Ku-band Uplink Beam



1st contour:	2.00 dB/K
2nd contour:	0.00 dB/K
3rd contour:	-2.00 dB/K
4th contour:	-4.00 dB/K
5th contour:	-6.00 dB/K



ASIA PACIFIC DISTRIBUTOR CONFERENCE

Satellite Scrambling Overview

JIM BEVERIDGE

GENERAL MANAGER

PAY TV

PACE MICRO TECHNOLOGY LTD.

The Myth of Security

"The VideoCipher system is a very sophisticated system, tamperproof and undefeatable"

General Instruments
VideoCipher Division 1986

"The issue of descrambler security is no longer 'will it be broken?' but rather 'when it will be broken."

General Instruments
VideoCipher Division 1991

Satellite Pay TV

The Basics

- Secure Scrambling
- Proven Data Encryption
- Direct Access To Individual Subscribers
- Subscriber Management System

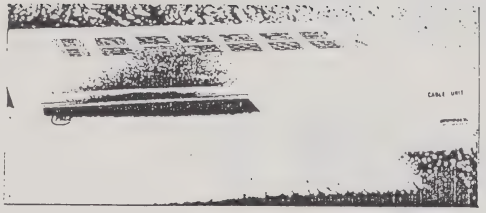
Agenda

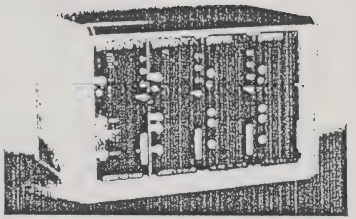
1. Technology Overview
2. Business Directions
3. Future Dimensions

Technology Overview

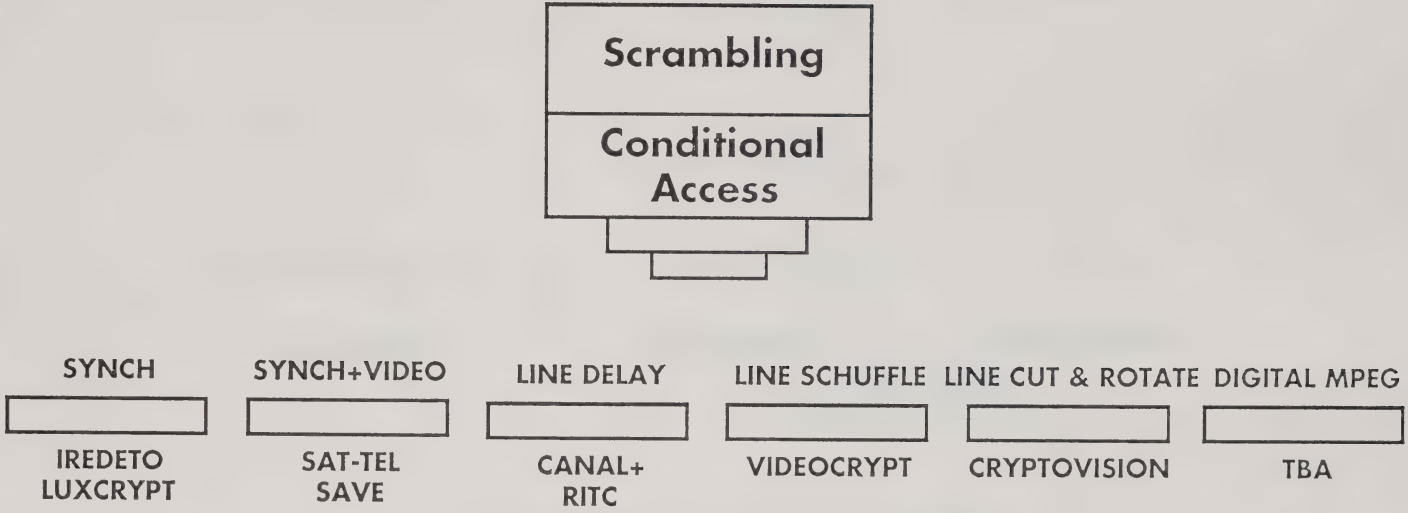
Basic Pay TV System

Pay TV System

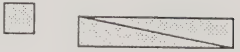
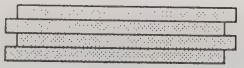




Conditional Access/ Scrambling Methods Europe



Soft Scrambling

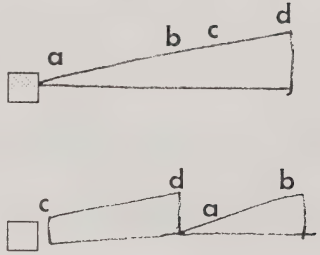
SYSTEM	EXAMPLE	HACKED?
Sync Suppression		Yes
Video Inversion		Yes
Video Delay		Yes

Hard Scrambling

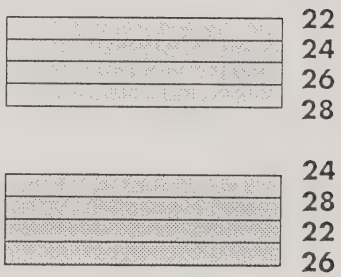
SYSTEM

Line Cut & Rotate

EXAMPLE



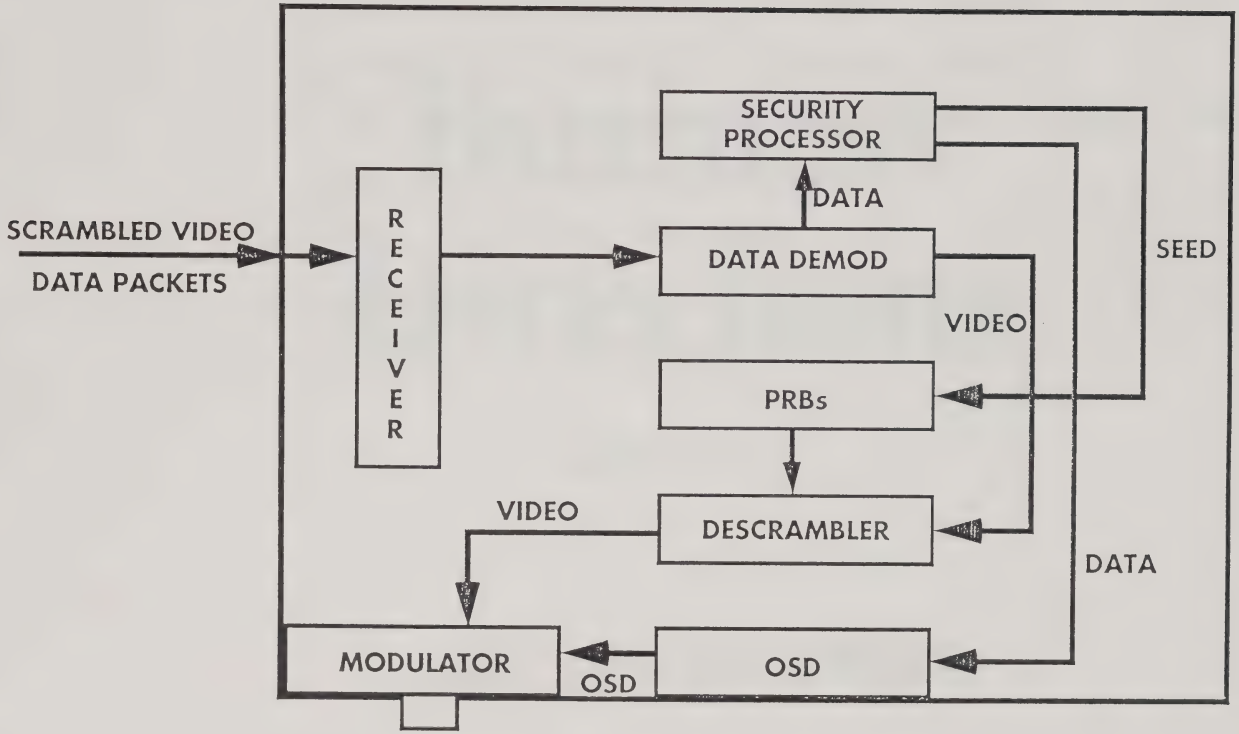
Line Schuffle



Basic Hard Scrambling

- Data packets in the VBI
- Data packets comprise of system data, management data
- System data contains info on picture scrambling
- Management data combines info on entitlements and blacklist data

Technology


SECURITY PROCESSOR
DATA
SCRAMBLED VIDEO
DATA PACKETS
RECEIVER
DATA DEMOD
SEED
VIDEO
PRBs
VIDEO
DESCRAMBLER
DATA
MODULATOR
OSD
OSD
IRD

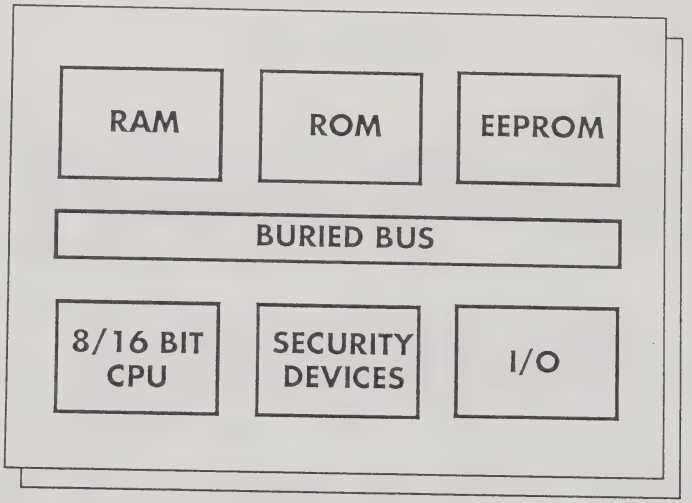
The Mathematics

The Tools

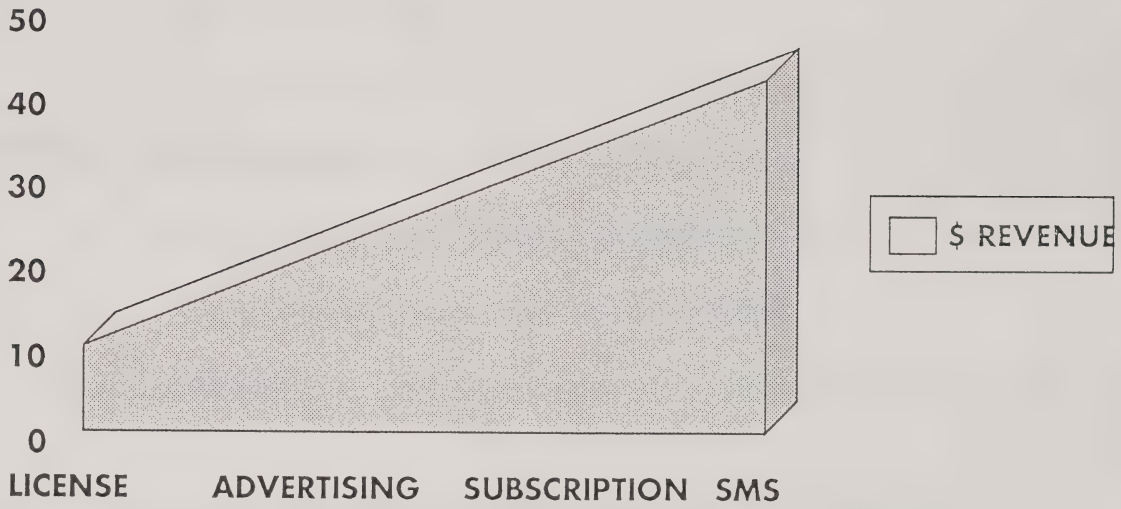
- One way functions $f(x)=y$
- Hash functions $x+y$ where x,y $(x \neq y)$ $f(x)=f(y)$
- DES - 1977, NSA, Encryption
- RSA - Authentication and encryption
  - P=public key S=secret key N=Xxyp (x&y Large primes)
- Encryption > Cipher Text = $(\text{Plaintext})^{P}$ Mod N
- Decryption > Plaintext = $(\text{Ciphertext})^{S}$ Mod N

Business Directions

The Smart Card



Pay TV Revenue



Subscriber Management System

- Issue entitlements to authorisation centre
- Log subscriptions onto the data base
- Collect Monies
- Interface with banks
- Issue Smart Cards
- Handle pay-per-view

Smart Card System

SECURITY - Upgradeable

- Replaceable

BUSINESS FLEXIBILITY - Customise system structure

- Multi theme - multi programming

COST BENEFITS - Eliminate expense of decoder replacements

Smart Card Security Features

- Fuse protection
- Buried Bus
- EEPROM difficult to read
- Bytes physically scattered
- Unique identification

Smart Card System

MEMORY - RAM, ROM, EPROM, EEPROM

PROCESSING - 8/16BM

PRICE - Memory - 75 cents > $10

Smart - $3.00 > $30

SIZE - Credit card dimension - Pay TV

Chip size + - GSM

Future Dimensions

Digital Broadcast Services Report Card

REPORT CARD

Availablity of consumer technology	C+
Applications	- incomplete
Effort	A (shows great potential)
Affordability	F

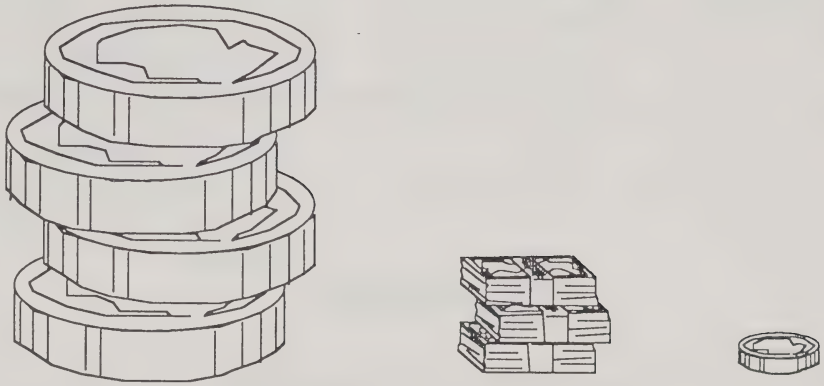
Fundamental Laws of Nature

- Levels of Semiconductor Integration double every 1.5 years
- Doubling volume manufactured reduces unit costs by 30%
- System Reliability increases with increasing levels of semiconductor integration

Memory Technology

1 Megabyte Memory

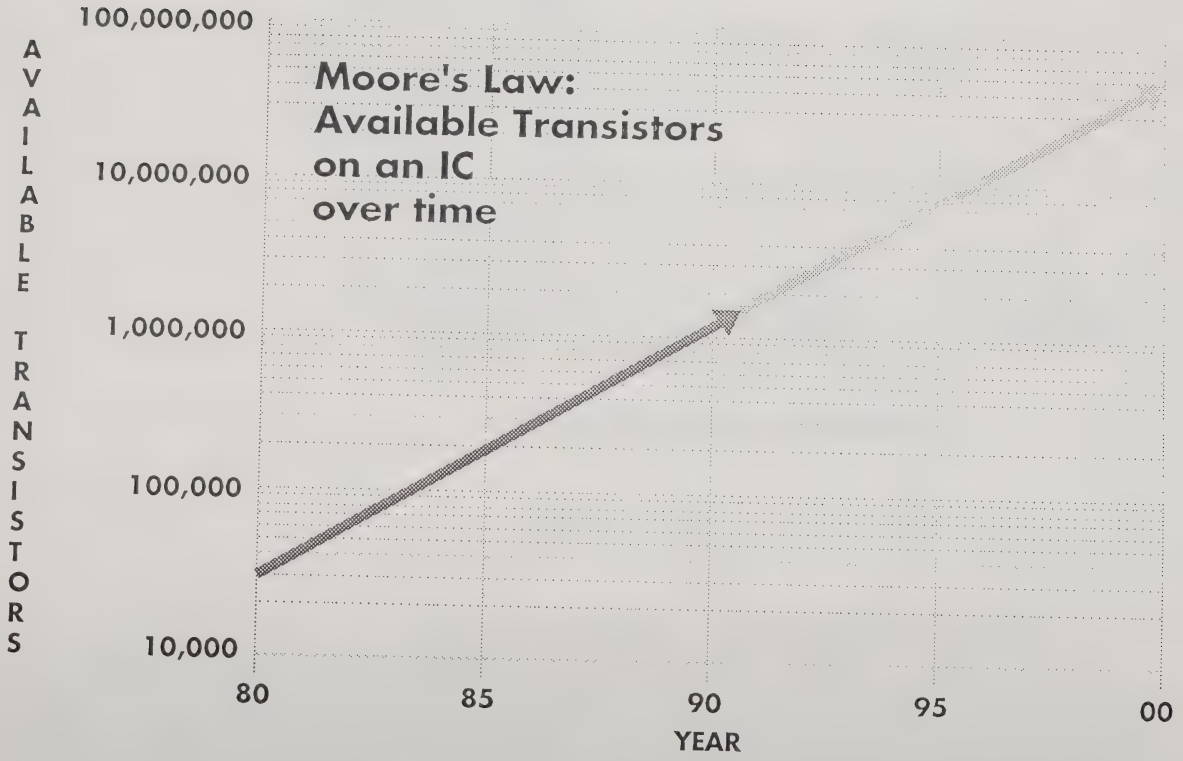
1960	1990	2000
$1,000,000	$40	$1



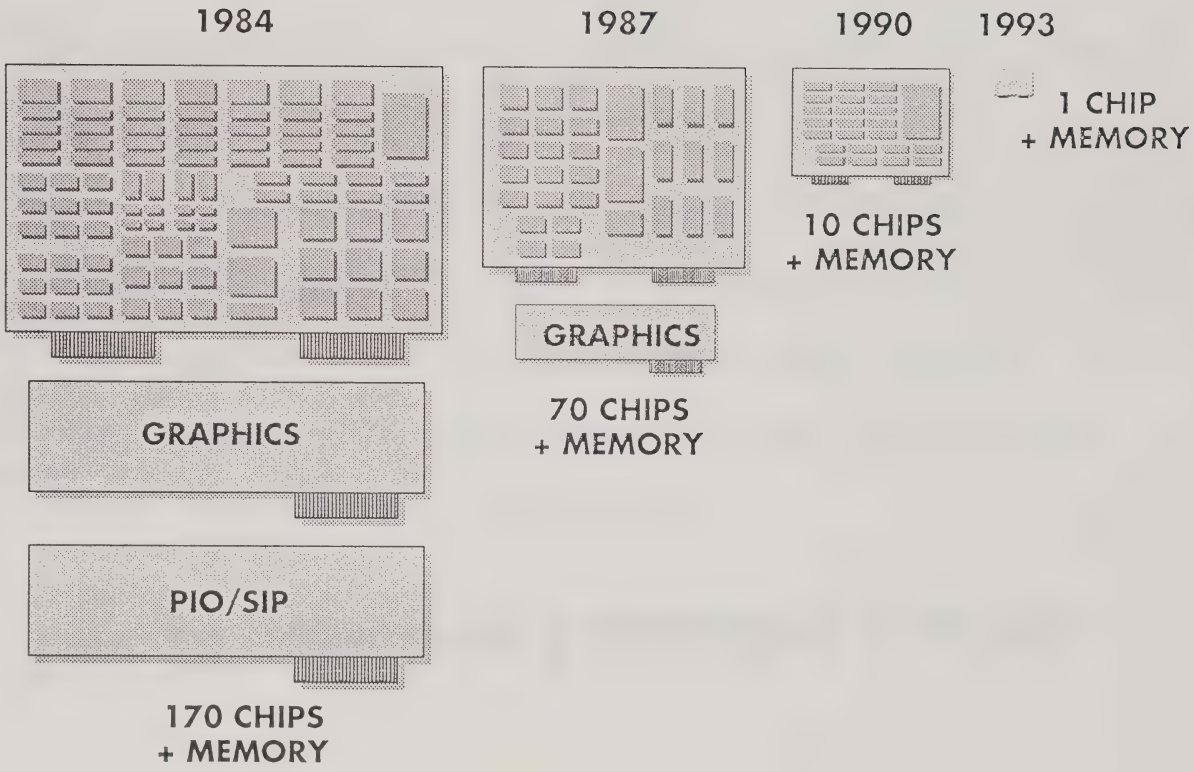
Source: IDC

Moore's Law:

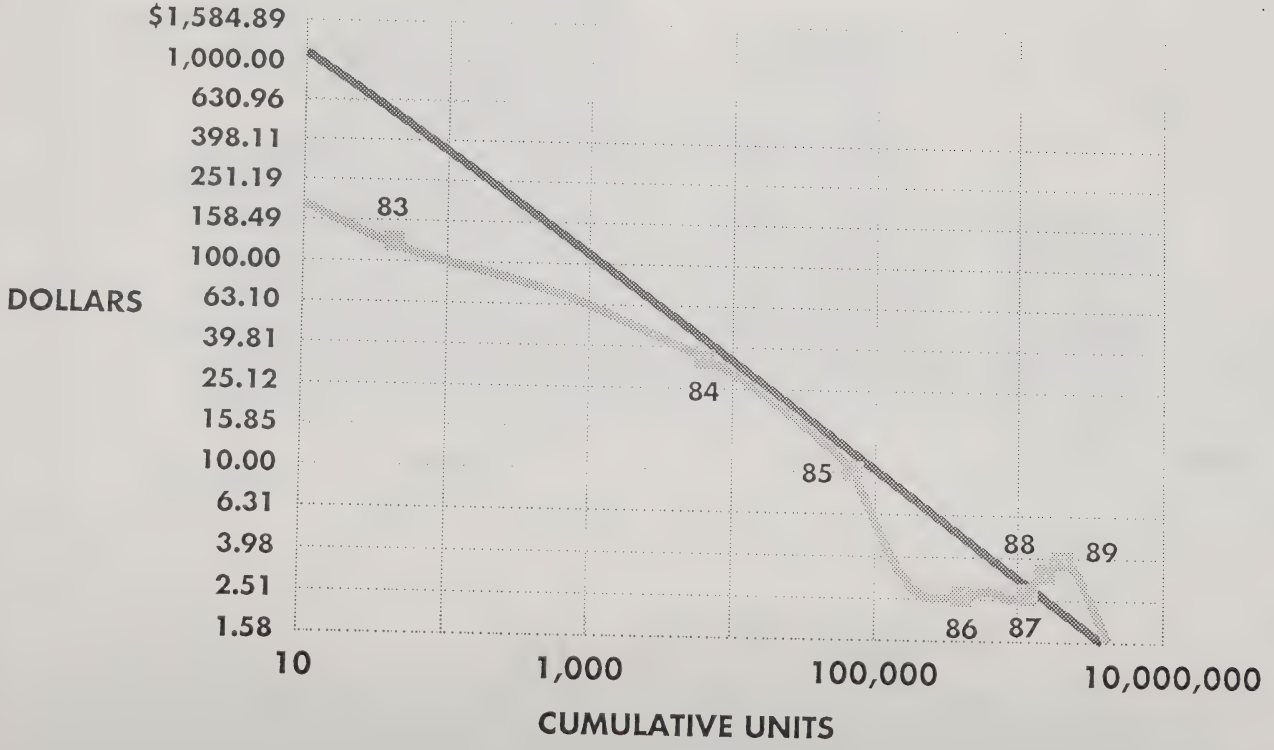
莫尔定律



PC Integration



The Production Learning Curve



Ideal Digital Video Broadcasting

- Overall approach taking into account needs of satellite, cable, terrestrial
- Introduction end 1994/first half of 1995
- Redistribution through cable possible without remultiplexing
- Cable operators have possibility to create different bouquets
- One access control system - or decoders dealing with multiple
- Ability to replace original access control data with local control data
- IPR freely licensable under resonable terms

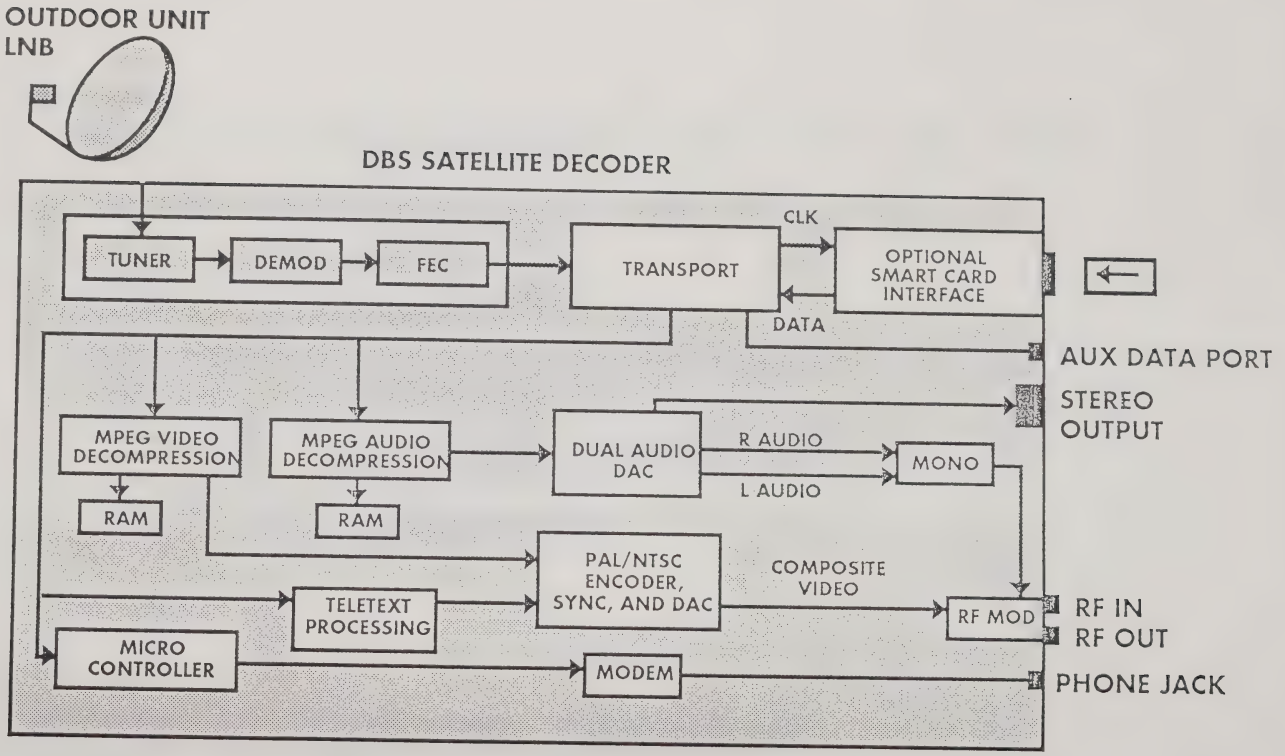
Digital Video Broad - The Reality

- Every man for himself with satellite looking to out position cable
- The cost/availability of key components will slow intro
- One access control system fantasy
- Cable operators will have to make commercial deals with satellite broadcasters to allow introduction of local access control
- IPR a real battleground

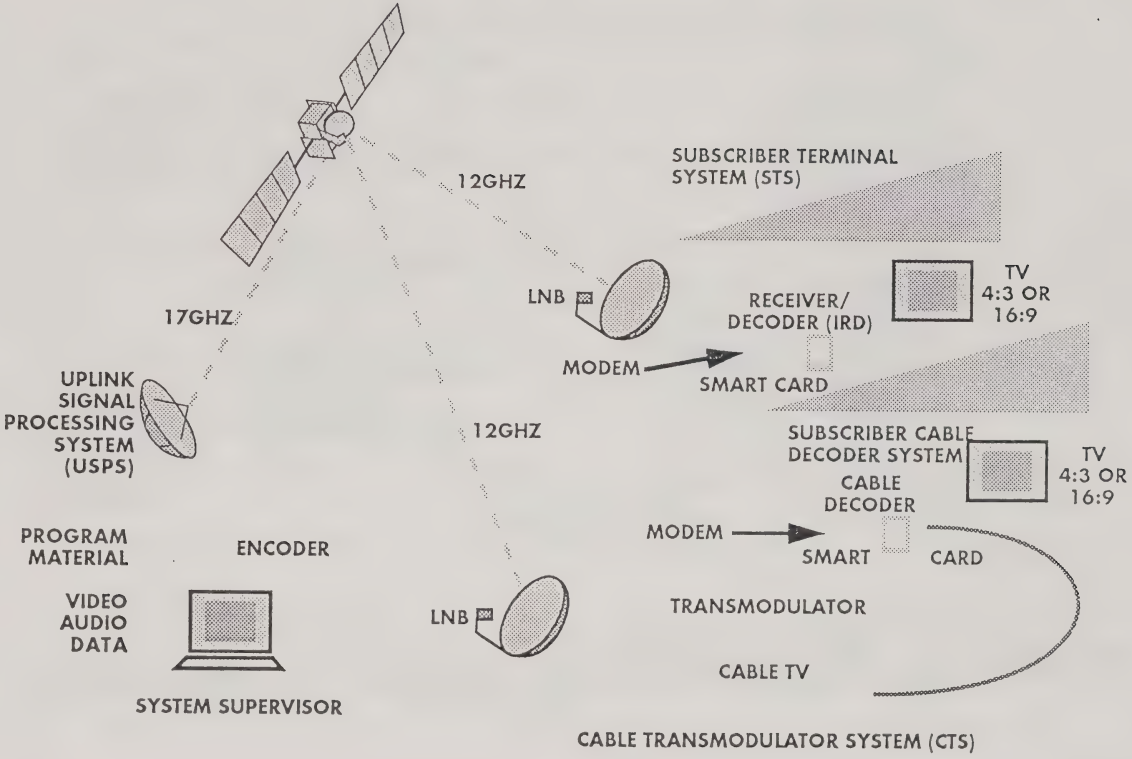
Digital Decoder

- Demodulator
- Transport/Demultiplexer
- MPEG Video
- MPEG Audio
- Modem
- RF Modulator

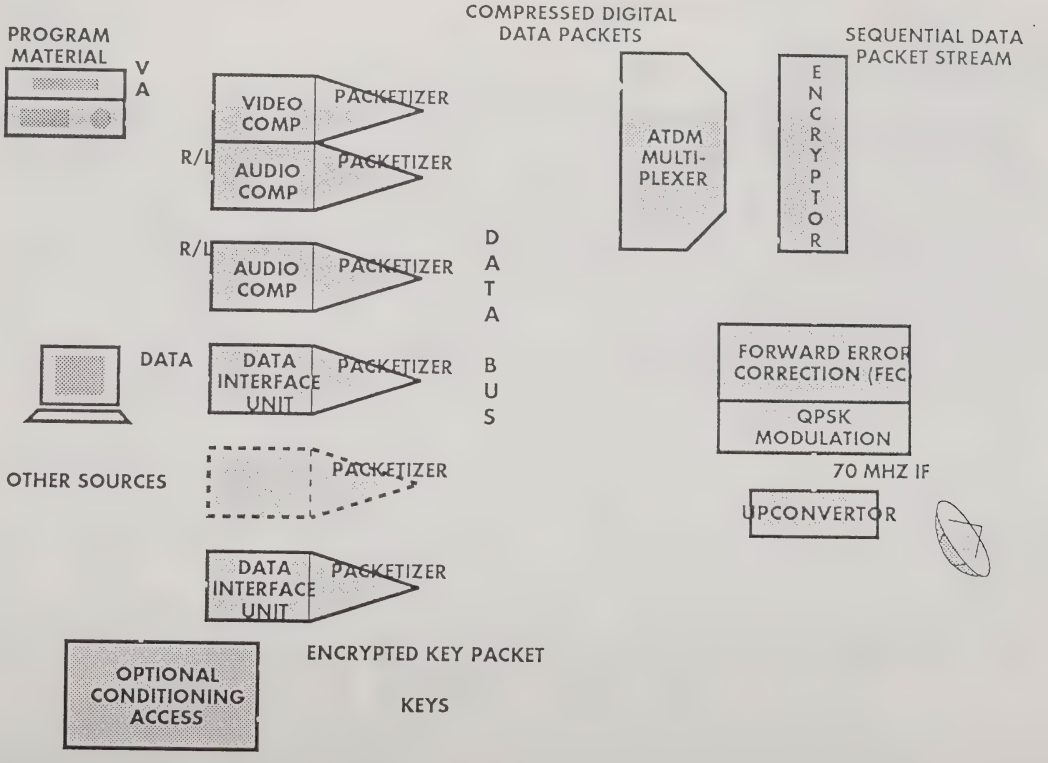
IRD


OUTDOOR UNIT
LNB
DBS SATELLITE DECODER
TUNER
DEMOD
FEC
TRANSPORT
CLK
DATA
OPTIONAL SMART CARD INTERFACE
AUX DATA PORT
STEREO OUTPUT
MPEG VIDEO DECOMPRESSION
MPEG AUDIO DECOMPRESSION
DUAL AUDIO DAC
R AUDIO
L AUDIO
MONO
RAM
RAM
PAL/NTSC ENCODER, SYNC, AND DAC
COMPOSITE VIDEO
TELETEXT PROCESSING
RF MOD
RF IN
RF OUT
MICRO CONTROLLER
MODEM
PHONE JACK

Digital DBS TV System



Satellite Uplink Processing System

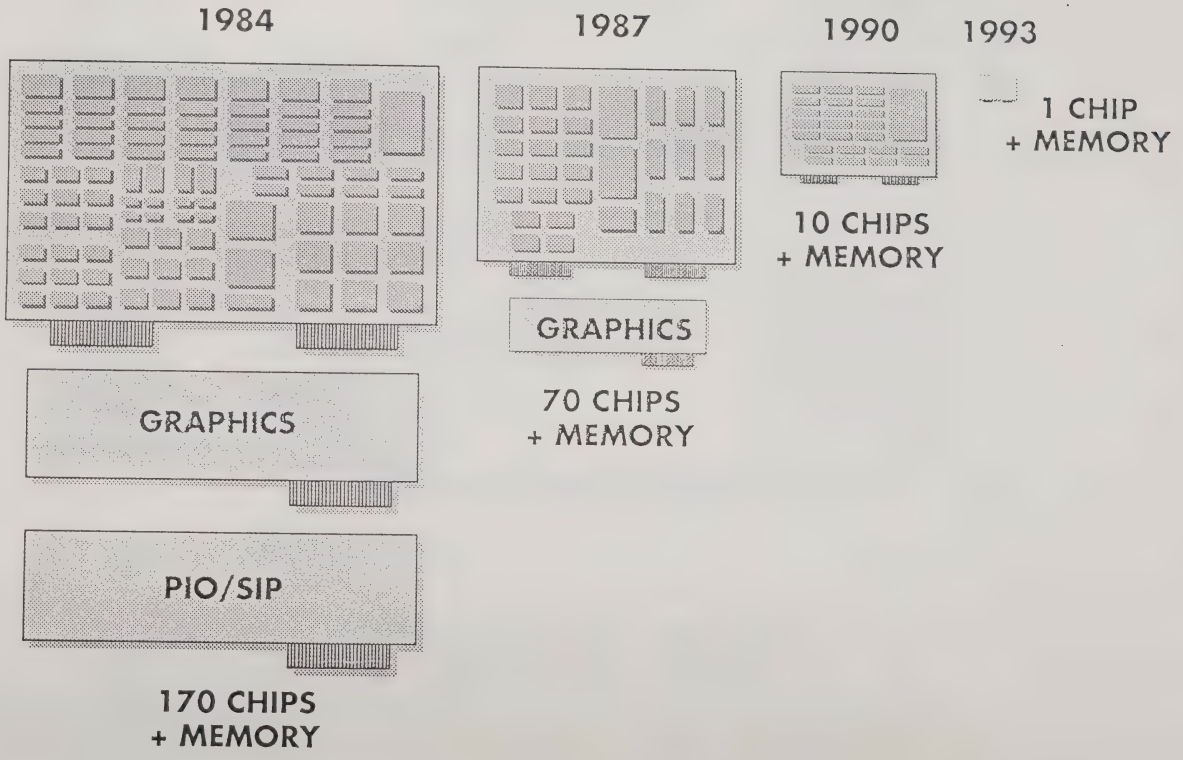


Digital System

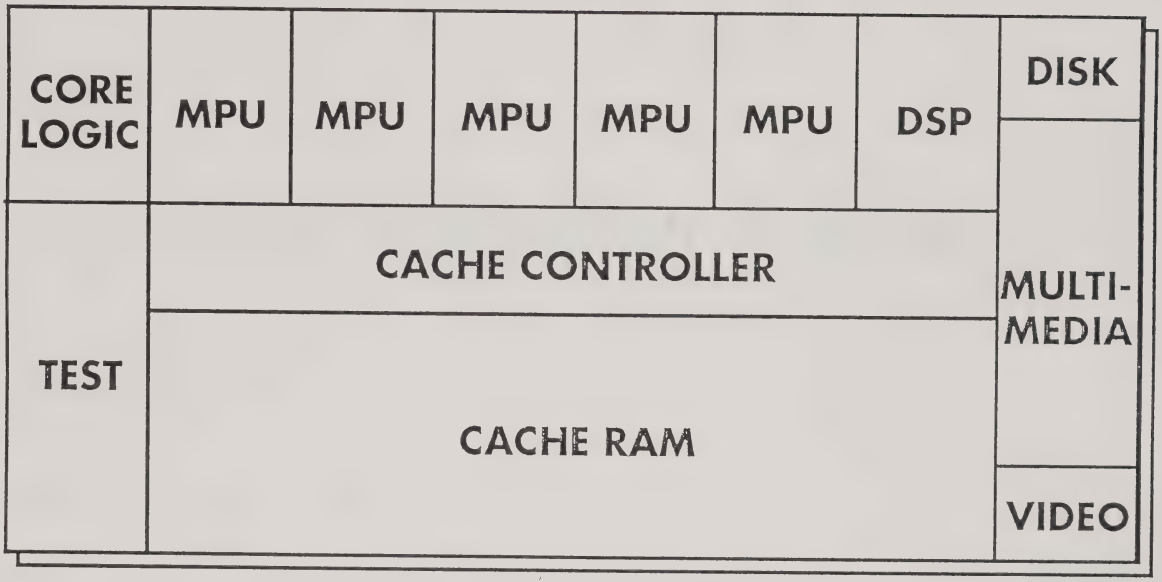
SERVICE DATA RATES

MPEG Video	Film PPV	1.152Mbps
	Film Broadcast	3.956Mbps
	Live sports	4.608Mbps
	16:9 Wide aspect	5.760Mbps
	CCIR 601	8.069Mbps
	HDTV	19.0+Mbps
Musical Audio	Mono	0.128Mbps
	Stereo	0.256Mbps
	Surround	0.500Mbps
Service Control	Access	Nx0.303072Mbps
Service Info	GUI	NX?

PC Integration



Semireceiver Block Diagram, 2000

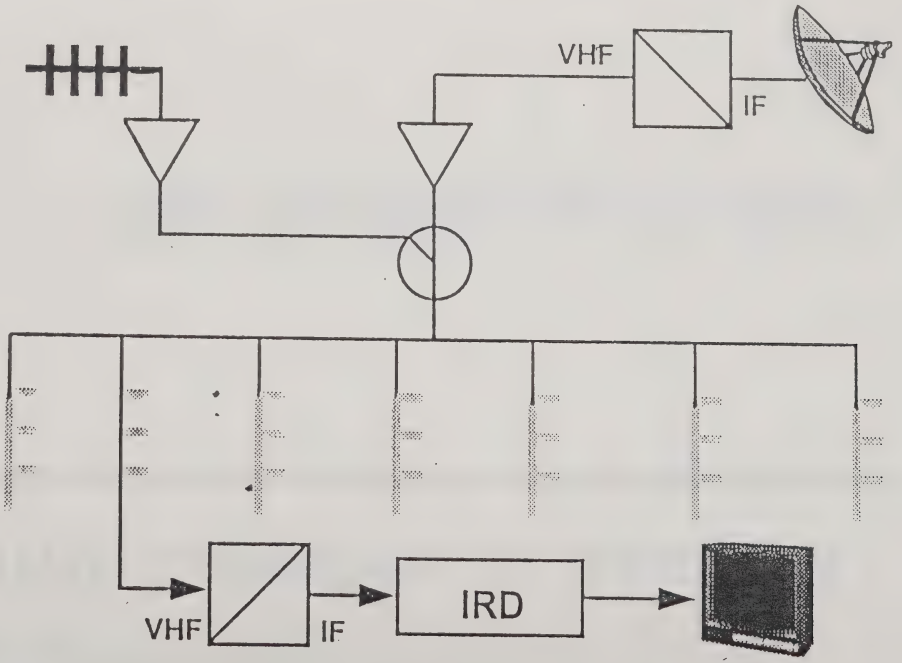


Home Satellite TV Asia '93

Pay Television in Asia

STAR NETWORK TV

SMATV-Direct



STAR TV NETWORK

Subjects to be discussed

- News Corporation
- Pay TV Programming
- Technical Issues
- Profit Potential
- ASA Dealer Network

STAR™ TV NETWORK

What can you do for STAR?

- Be Patient!
- Contact Information
- Fax Feedback
- Identify Cable Operators

STAR™ NETWORK TV™

Technical Issues

- Digital or Analog?
- Cost of decoder
- Channel capacity
- On-going evaluation process
- SMATV-Direct

STAR TV NETWORK

STAR TV ASA

Dealer Network

- Approved STAR Agent
- Regular Information
- Benefits
- Priority Equipment Supply

STAR TV NETWORK

What will STAR do?

- ASA Dealer Network
- Introduce ASA Dealers to Decoder Manufacturers
- Extensive on-air advertising
- Customer Service will suggest Approved Dealers

STAR™ NETWORK TV™

Pay TV Programming

- **4 New Channels to Wharf Cable, Hong Kong**
  - STAR Movie Channel
  - STAR Asian Movie Channel
  - STAR Children's Channel
  - Asian News & Business Channel
- **Future Move to Satellite**

STAR™ NETWORK TV™

Profit Potential

- Subscription Revenue = Better Programmes
- Decoder Sales
- IRD Sales
- CATV upgrades

STAR™ TV NETWORK

News Corporation

- **Broadcasting Expertise**
  - British Sky Broadcasting
  - Fox Network Television
  - Fox Broadcasting Company
  - Channel Seven Network
- **Programming**
  - Twentieth Century Fox Films
  - Twentieth Television
- **Technology**
  - VideoCrypt (with Thomson)
  - News DataCom

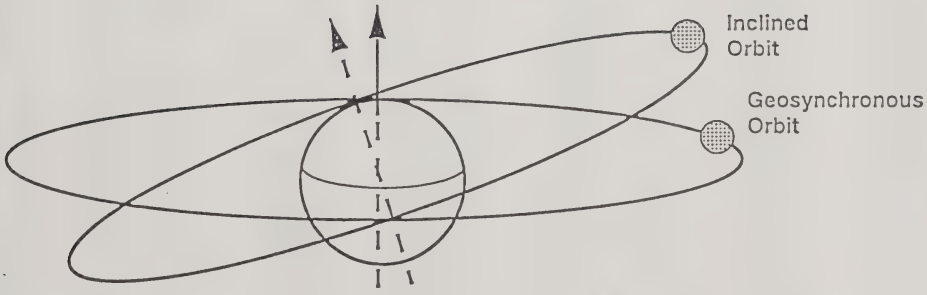
STAR™ TV NETWORK

Satellite TV Asia 93

Tracking Inclined Orbit Satellites

Presented by:

Jeffrey Keating
MLE, Inc.



SATELLITE TV ASIA 93

Inclined Orbit Satellite Tracking

I. SATELLITE ORBITS (SEE FIGURE 1)

A. MAN-MADE SATELLITES CAN BE PLACED IN EQUATORIAL, POLAR, OR INCLINED ORBITS.

B. EQUATORIAL ORBITS LAY IN A PLANE PARALLEL TO THE EARTH'S EQUATOR. GEOSTATIONARY SATELLITES OCCUPY EQUATORIAL ORBITS.

C. A POLAR ORBIT HAS A PLANE THAT IS MORE OR LESS PARALLEL TO THE EARTH'S POLAR AXIS.

D. ORBITS THAT ARE OFFSET IN DEGREES FROM THE EARTH'S EQUATORIAL PLANE ARE CALLED "*INCLINED ORBITS*".

E. A GEOSYNCHRONOUS SATELLITE MAY OCCUPY EITHER AN EQUATORIAL ORBIT OR AN INCLINED ORBIT.

Inclined Orbit Satellite Tracking

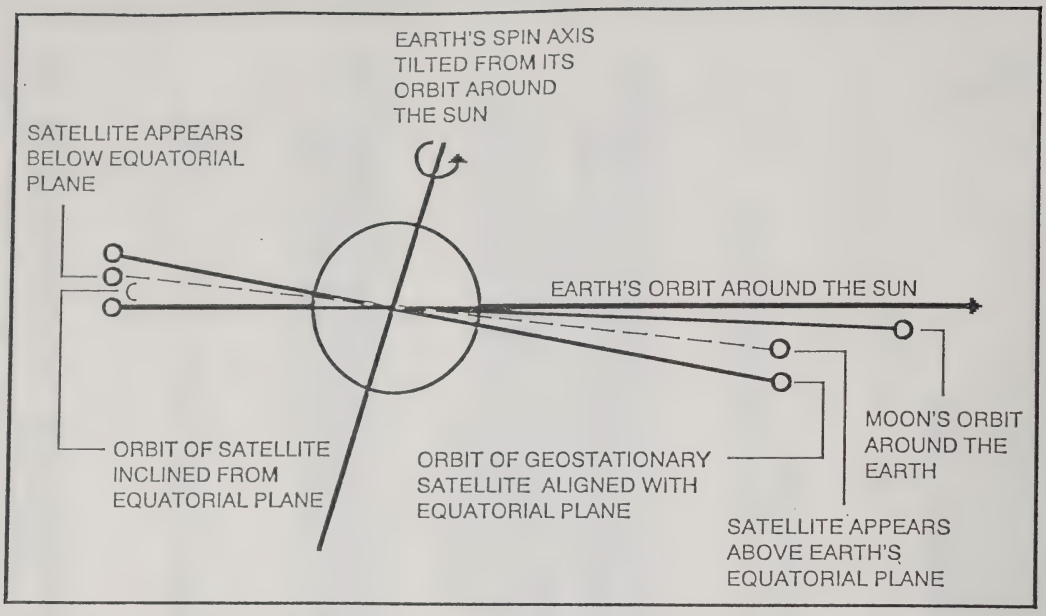
II. UNDERSTANDING ORBITAL INCLINATION

A. GEOSTATIONARY SATELLITES ARE CONSTANTLY BEING SUBJECTED TO FORCES SUCH AS THE GRAVATIONAL ATTRACTION OF THE SUN AND MOON, THE RADIATION FORCE FROM SUNLIGHT, AND THE EARTH'S GRAVITIONAL FIELD CAUSING THE SATELLITE TO DRIFT AWAY FROM ITS ASSIGNED SPOT OVER THE EQUATOR. (SEE FIGURE 2).

B. THE SATELLITE'S *DEGREES OF INCLINATION* IS A MEASUREMENT OF THE DIFFERENCE BETWEEN THE EQUATORIAL PLANE AND THE ORBITAL PLANE OF THE SATELLITE.

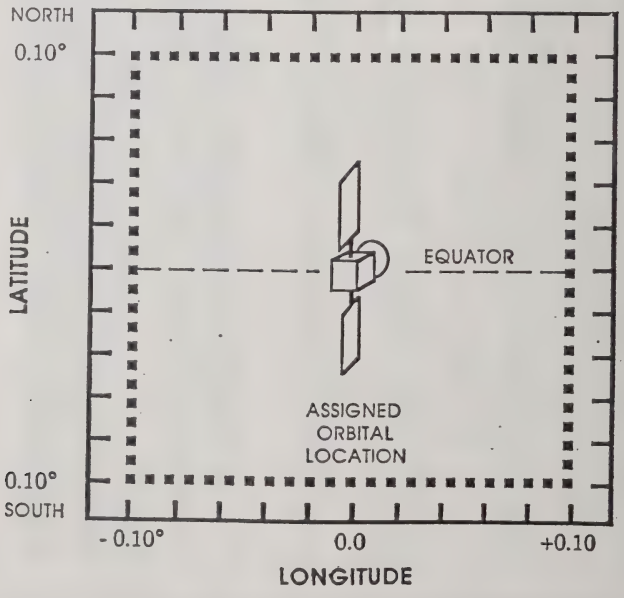
C. STATIONKEEPING IS PERFORMED TO KEEP THE SATELLITE IN ITS ASSIGNED ORBITAL POSITION.

D. NORMAL STATIONKEEPING PROCEDURES ALLOW THE SATELLITE TO WANDER 0.1 DEGREES IN N/S DIRECTION AND 0.05 IN E/W DIRECTION.



When viewed from the side, it can be seen that for the entire day the Sun and Moon pull on the satellite in the direction to align it with their orbits. With no North/South stationkeeping, the satellite's orbit is continuously pulled away from its desired orientation and becomes inclined with respect to the Earth's equatorial plane.

Geostationary Stationkeeping "Box".



Inclined Orbit Satellite Tracking

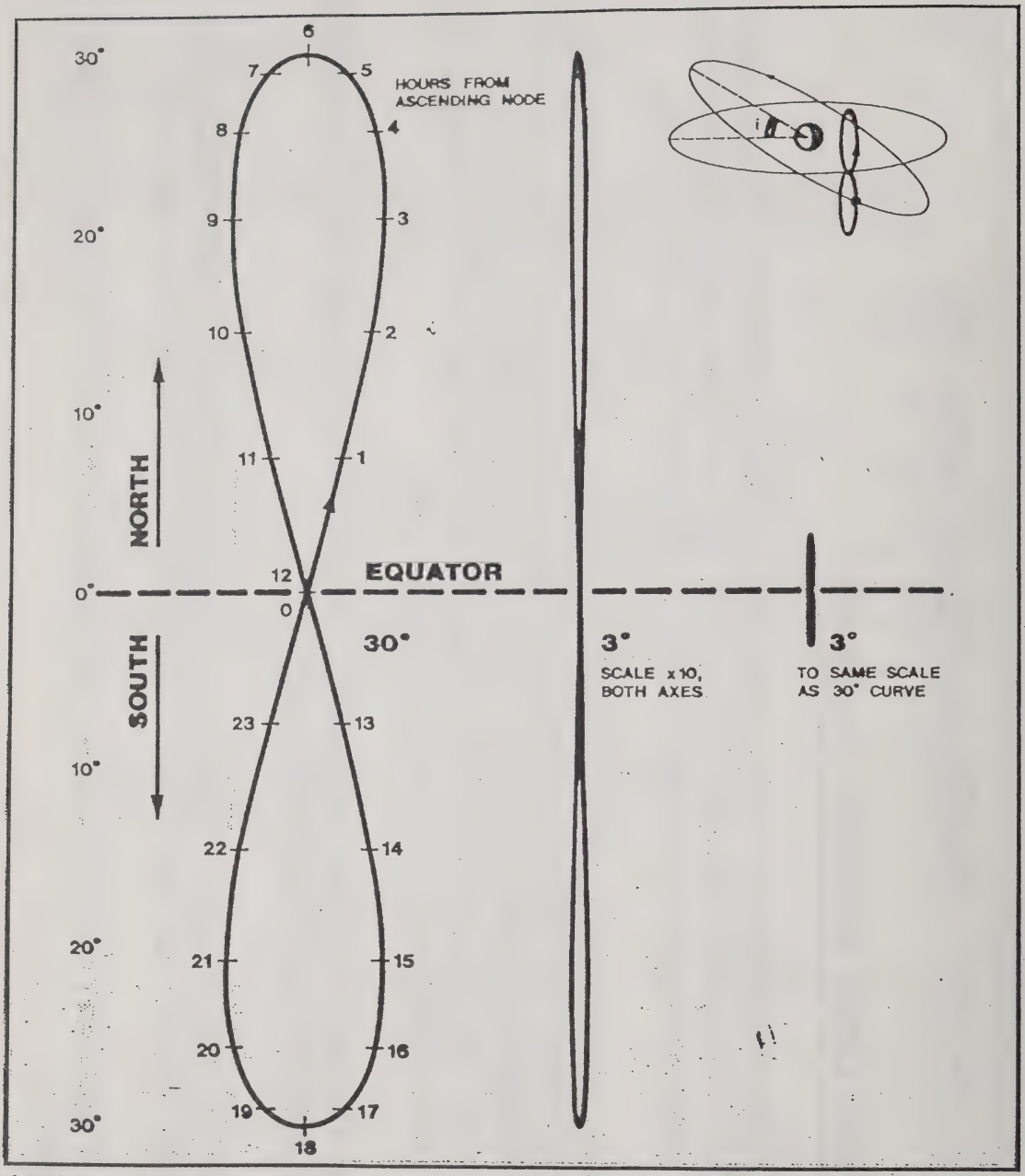
E. THE MAJORITY OF THE ONBOARD STATIONKEEPING FUEL IS USED TO CORRECT N/S DRIFT OF THE SATELLITE. ELIMINATING N/S STATIONKEEPING WILL GREATLY INCREASE THE USABLE LIFETIME OF THE SATELLITE.

F. ALLOWING N/S DRIFT CREATES AN INCLINED ORBIT. AS SEEN FROM THE GROUND, THE INCLINED ORBIT DESCRIBES A FIGURE 8 PATTERN IN THE SKY. (SEE FIGURE 4). NOTE THAT FOR SMALL DEGREES OF INCLINATION THE WIDTH OF THE FIGURE 8 IS VERY SMALL, APPEARING ALMOST AS A STRAIGHT LINE PERPENDICULAR TO THE SATELLITE ARC.

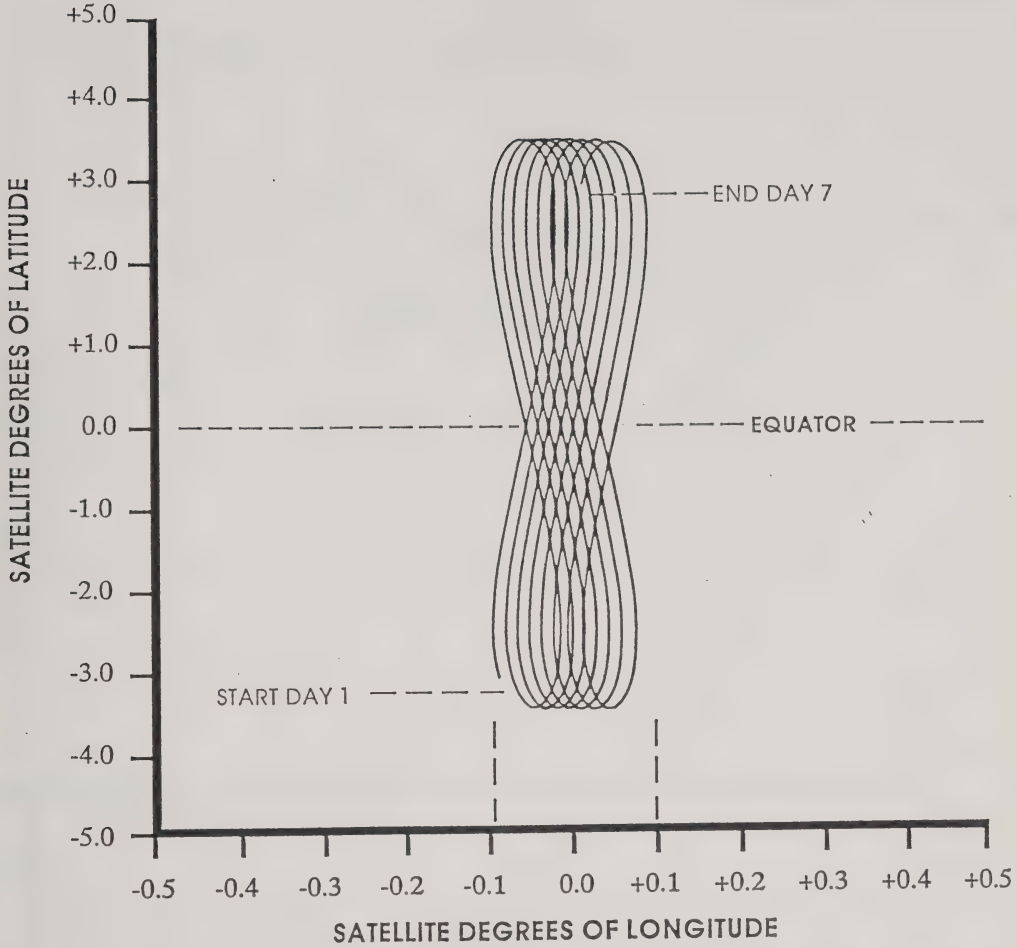
G. FIGURE 5 SHOWS THE SATELLITE MOTION WITH A 3.5 DEG. INCLINED ORBIT OVER A SEVEN-DAY PERIOD.

H. THE INCLINATION ANGLE OF THE SATELLITE WILL GRADUALLY INCREASE AT AN AVERAGE RATE OF 0.8 DEG. PER YEAR. (SEE FIGIRE 6).

I. SATELLITES IN INCLINED ORBIT OVER ASIA AND THE PACIFIC RIM. (SEE FIGURE 7).

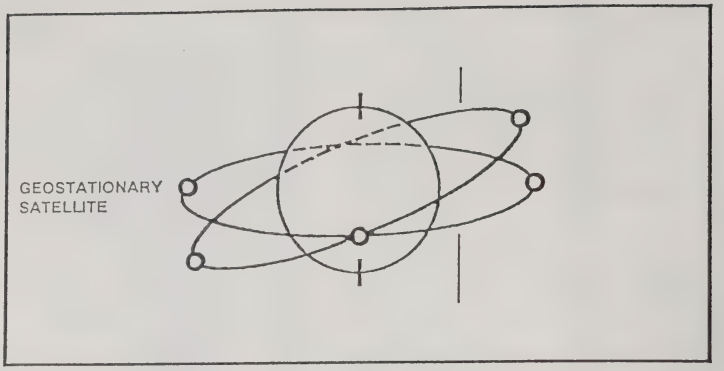


As viewed from the ground, the inclined orbit describes a figure eight type of motion with the satellite north of the equator for twelve hours and south of it for twelve hours. The width of the figure eight is very small which, for low values of inclination, appears to be a line which lies perpendicular to the satellite arc.



Satellite Motion in 3.5° Inclined Orbit Over a Seven-Day Period. The above plot of a 3.5° inclined orbit satellite over a seven day period shows the degree of East/West motion which will occur. At the end of the 7-day period, the satellite operators will initiate stationkeeping commands that will reverse the direction of the East/West drift so that the satellite remains within its ±0.1°longitudinal "box". Whenever the inclined orbit exceeds 4 degrees of North/South movement, the width of the figure-eight motion will begin to exceed ±0.1 degrees.

Geosynchronous equatorial versus geosynchronous inclined orbits.



Yearly Orbital Inclination Fluctuations Caused by Solar and Lunar Effects

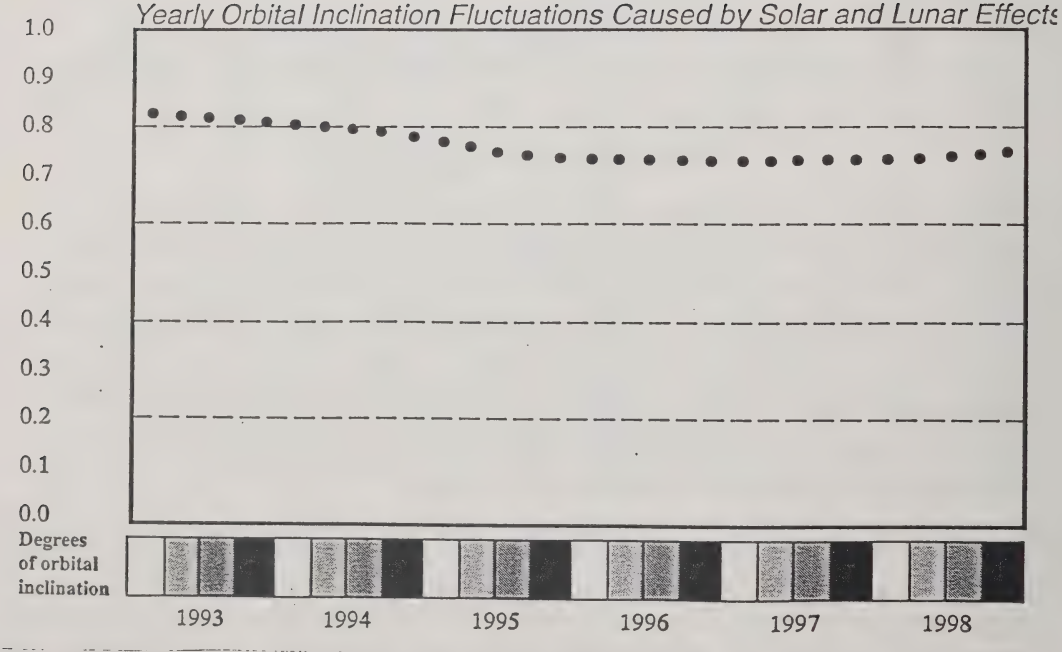
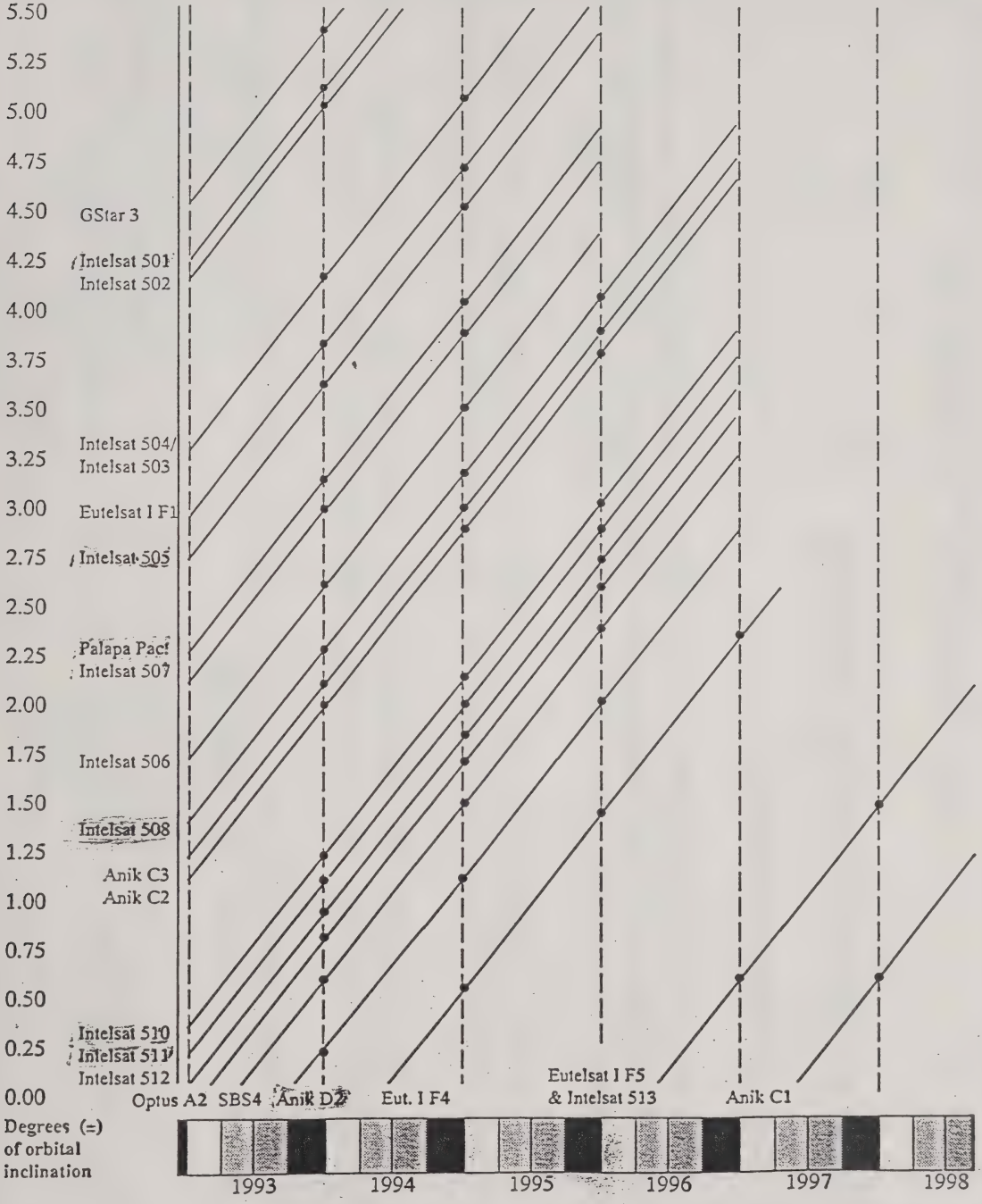


FIG. 1-9. Estimated Orbital Inclinations for Existing Communications Satellites



Inclined Orbit Satellite Tracking

1. THE COMSAT MANEUVER

A. FIGURE 8 ILLUSTRATES THE COMSAT MANEUVER. THE ANTENNA BEAM PATTERN REMAINS CENTERED OVER THE DESIRED COVERAGE AREA BY COMMANDING SUBTLE CHANGES OF THE SATELLITE'S "*ATTITUDE*".

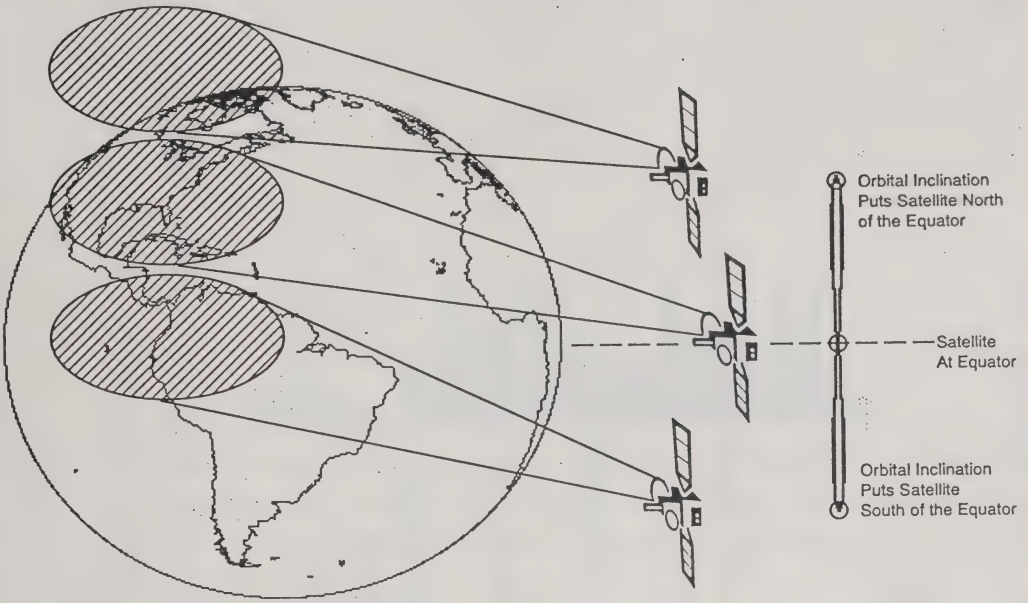
B. SOME FLUCTUATIONS IN EIRP STILL OCCUR. GREATEST FOR LOCATIONS NEAR THE EDGE OF THE SATELLITE COVERAGE AREA (FOOTPRINT).

C. THE AMOUNT OF VARIANCE WILL ALSO BE AFFECTED BY THE TYPE OF SATELLITE BEAM IN USE (GLOBAL, HEMISPHERIC, ZONE, OR SPOT).

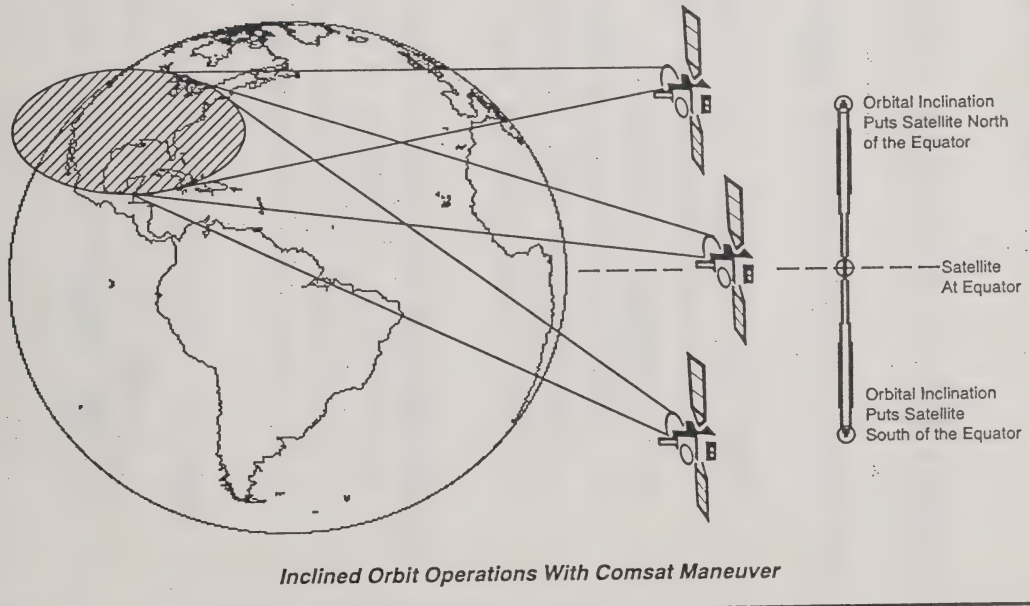
D. VARIANCES ALSO WILL INCREASE OVER TIME, AS THE INCLINATION OF THE SATELLITE INCREASES.

E. BUILD A MARGIN OF SAFETY INTO THE DOWNLINK TO COMPENSATE FOR THESE FLUCTUATIONS IN RECEIVED SIGNAL STRENGTH.

THE EFFECT OF THE COMSAT MANEUVER ON INCLINED ORBIT OPERATIONS



Inclined Orbit Operations Without Comsat Maneuver



Inclined Orbit Operations With Comsat Maneuver

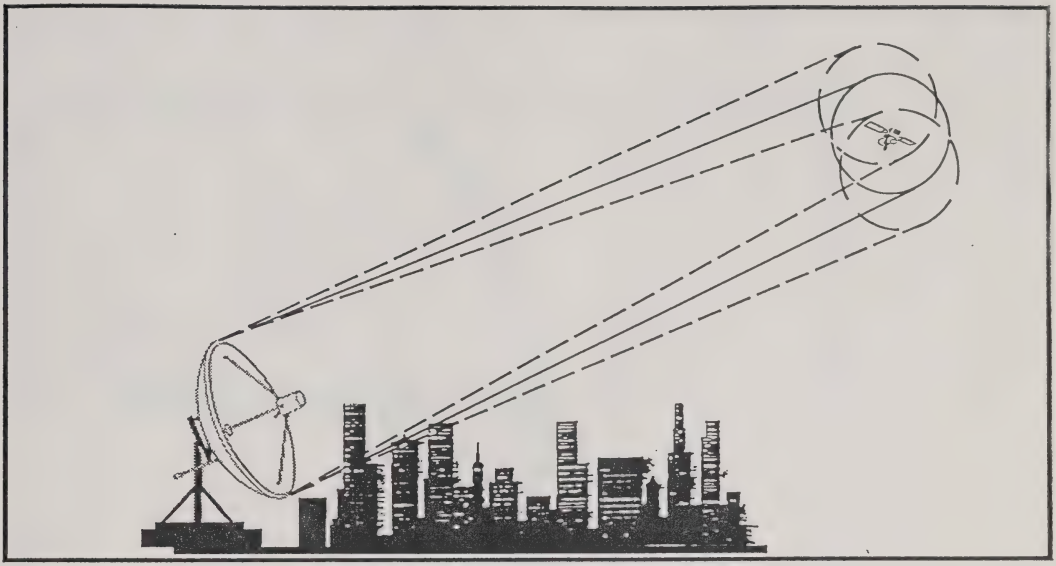
Inclined Orbit Satellite Tracking

1. ANTENNAS AND ANTENNA MOUNTS

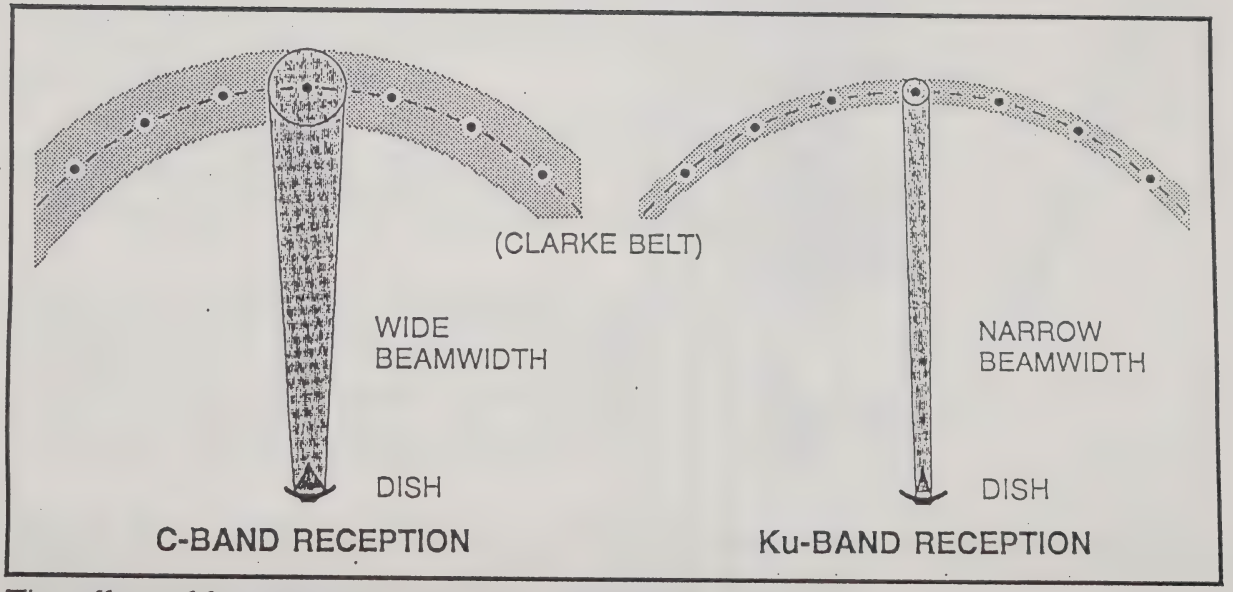
   A. POINTING ERROR AND BEAM WIDTH (SEE FIGURE 9).
      1. ANTENNA SIZE OR "*APERTURE*".
      2. ANTENNA DESIGN.
      3. SATELLITE FREQUENCY. (SEE FIGURE 10).
      4. DEGREE OF INCLINATION.
      5. MOTORIZATION OF THE ANTENNA MOUNT.

   B. MINIMIZING ANTENNA POINTING ERROR.
      1.CARRIER TO NOISE RATIO (C/NR).
      2. INCREASE ANTENNA APERTURE.
      3. MOTORIZE ANTENNA MOUNT.

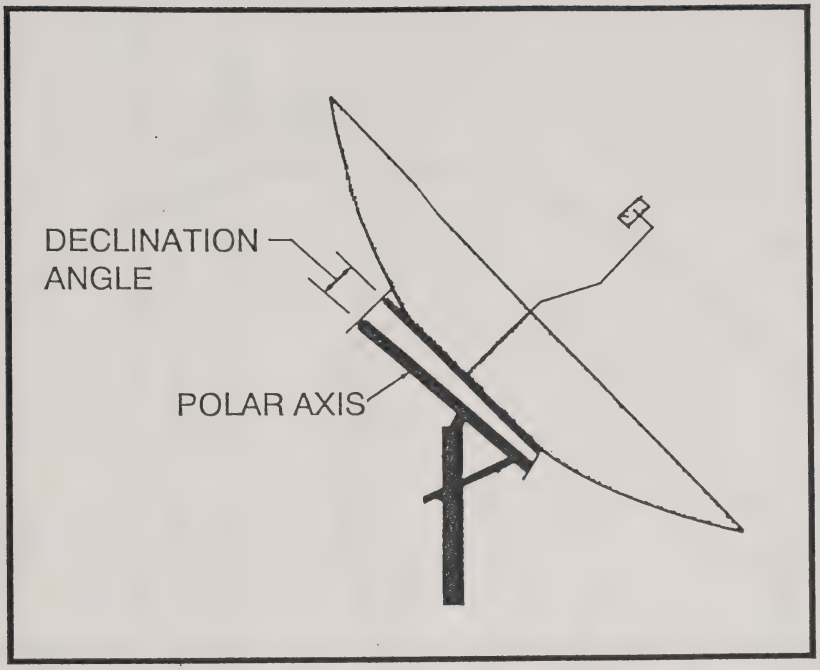
   C. SINGLE AXIS AND DUAL AXIS ANTENNA MOUNTS. (SEE FIGURES 11-13).
      1. AZIMUTH OVER ELEVATION (AZ/EL) MOUNTS.
      2. THE "MODIFIED" POLAR MOUNT.



The solid-line circle illustrates antenna boresighted onto the satellite with no pointing errors; the broken-line circles show that pointing errors have occured, but the satellite still falls within the 3 dB contours of the antenna's main beam.



The effect of frequency on antenna beamwidth.



*AN-
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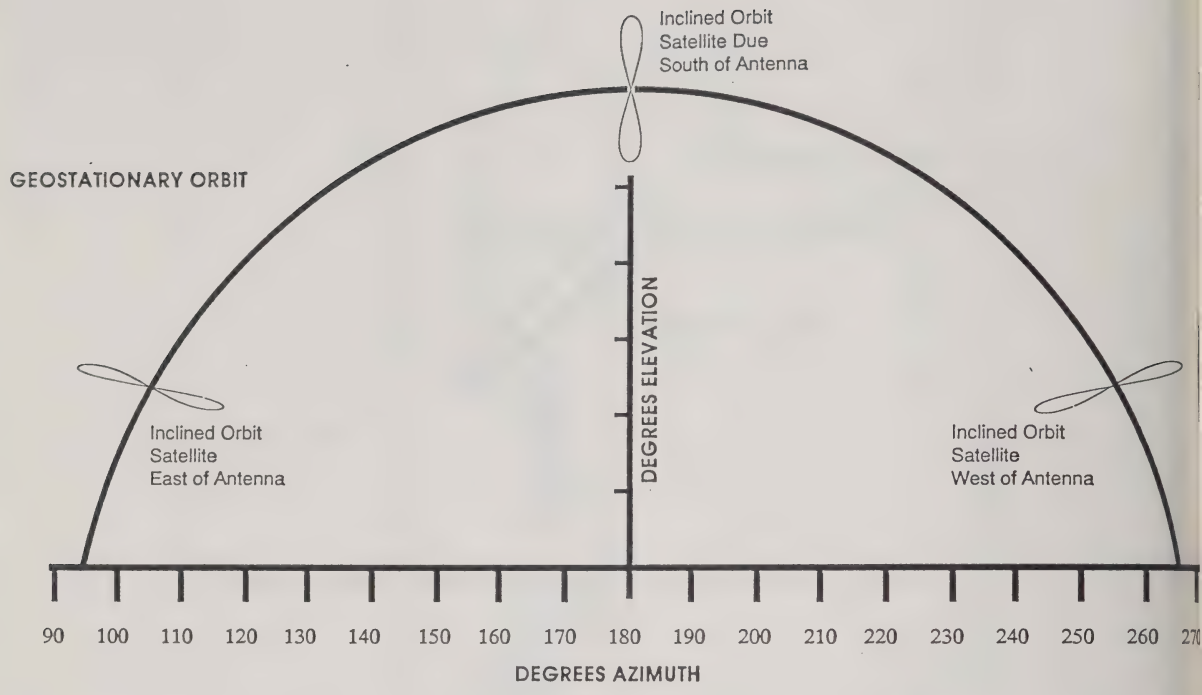


For satellites nearly due South (or due North for locations South of the Earth's equator) of the receive site, the apparent satellite motion is a thin vertical figure-8 pattern and the required tracking motion of the antenna is nearly all in elevation. If the antenna is East or West of the satellite the figure-8 pattern is tilted from vertical while remaining essentially perpendicular to the satellite arc. As the satellite and receive site differ more in Longitude, the required motion is in both azimuth and elevation. When the two Longitudes differ greatly, the tracking motion is nearly all in azimuth.

Inclined Orbit Satellite Tracking

MANUAL POSITIONERS MOVE THE ANTENNA EITHER ALONG ONE OR TWO MOUNT AXES. AUTOMATED POSITIONERS USE COMPUTER MICRO-PROCESSORS TO KEEP TRACK OF THE PRECISE LOCATION OF THE SATELLITE.

1. ANTENNA CONTROL UNITS (ACU'S)

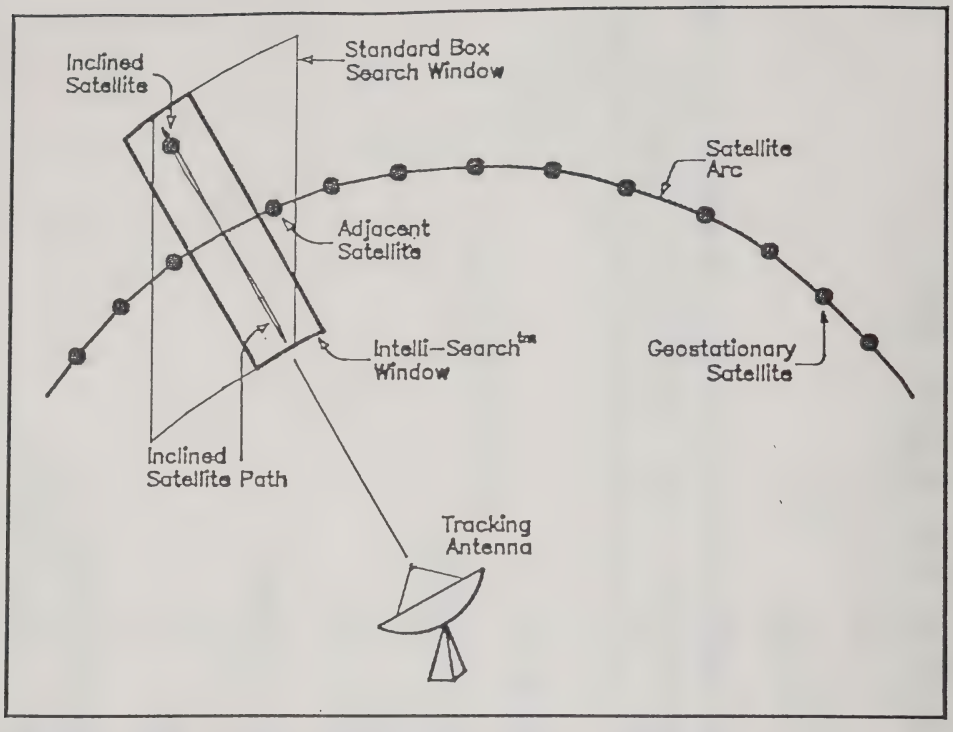
   A. THE MONOPULSE TRACKING SYSTEM.

   B. THE STEPTRACKING SYSTEM.

   C. THE PREDICTIVE TRACKING SYSTEM.

   D. PROGRAM TRACK SYSTEMS.

   E. LOW COST TVRO TRACKING SYSTEMS.
      a. ECHOSTAR NOMAD II. (SEE FIGURE 14).
      b. R.L. DRAKE ESR700E INTERNATIONAL RECEIVER WITH OPTIONAL INCLINED ORBIT ADAPTER (IAO 600).
      c. PANAREX PANSAT BR-4300E SATELLITE RECEIVER.



The RC2000B Intelli-Search Advantage. (Courtesy RCI.)

SATELLITE ANTENNAS AND FEEDHORNS

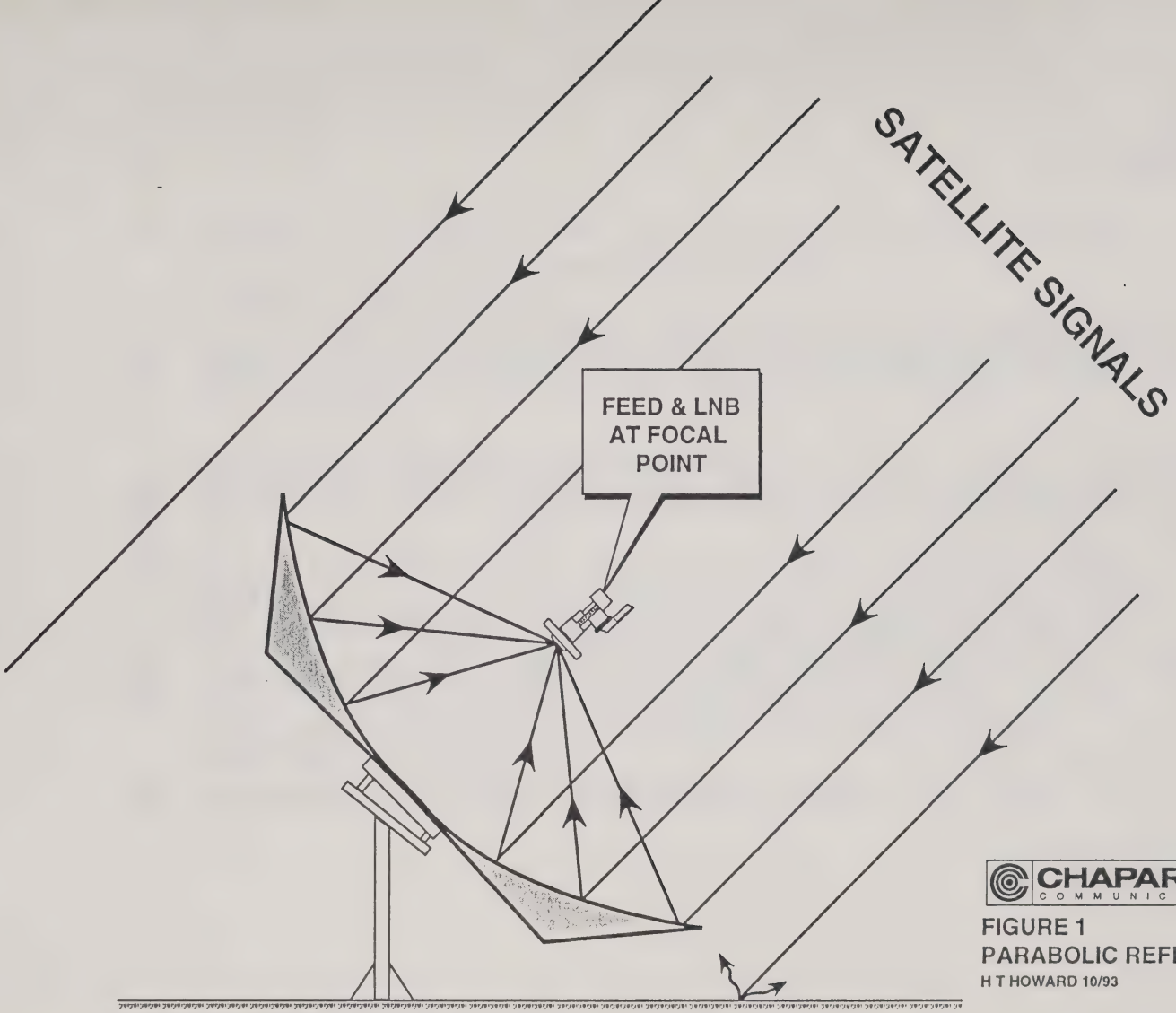
H. T. HOWARD

CHIEF TECHNICAL OFFICER

CHAPARRAL COMMUNICATIONS

SAN JOSE, CALIFORNIA, USA

- FIGURE 1 DEPICTS A PARABOLIC REFLECTOR, FEED AND LNB
- THE SATELLITE SIGNALS FALL TO THE EARTH MUCH LIKE RAIN AND ONLY THOSE THAT HIT THE COLLECTOR ARE USEABLE
- THE REFLECTOR SIZE MUST BE LARGE ENOUGH TO COLLECT THE SIGNALS NECESSARY TO PRODUCE A GOOD PICTURE
- I WILL DEMONSTRATE HOW TO CALCULATE DISH SIZE LATER IN THE PRESENTATION

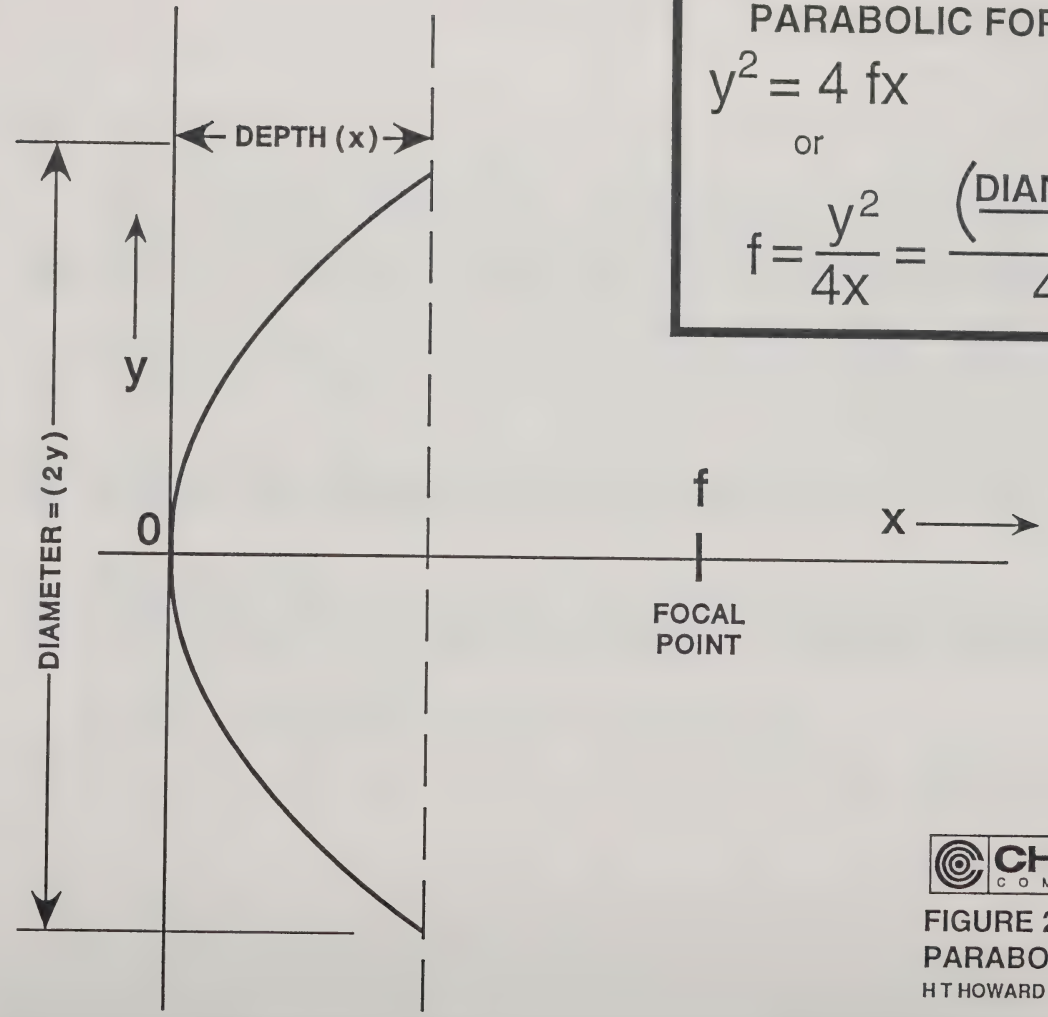


CHAPARRAL COMMUNICATIONS

FIGURE 1
PARABOLIC REFLECTOR
H T HOWARD 10/93

- SATELLITE SIGNALS ARE REFLECTED OFF THE PARABOLIC SURFACE
- THE PARABOLIC SHAPE IS USED BECAUSE ALL OF THE INCOMING SIGNALS REFLECT TO A SINGLE FOCAL POINT
- THEY ARE COLLECTED THERE BY THE FEED HORN WHICH ALSO SELECTS POLARITY
- THE LOW NOISE BLOCK DOWN CONVERTER (LNB) AMPLIFIES THE SIGNALS AND CONVERTS THEM TO A LOWER FREQUENCY

- FIGURE 2 SHOWS HOW TO CALCULATE THE FOCAL POINT LENGTH OF THE REFLECTOR
- THE GENERAL FORMULA FOR A PARABOLA IS SHOWN AT THE TOP
- IT CAN BE USED TO DESIGN OR CHECK A REFLECTOR
- USUALLY THE ONLY CALCULATION DONE IN THE FIELD IS ONE TO FIND THE FOCAL POINT DISTANCE
- ONE NEEDS TO KNOW THE DIAMETER AND DEPTH AND INSERT THEM IN THE SECOND EQUATION



PARABOLIC FORMULA

$$y^2 = 4fx$$

or

$$f = \frac{y^2}{4x} = \frac{\left(\frac{\text{DIAMETER}}{2}\right)^2}{4x}$$

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FIGURE 2
PARABOLA CALCULATIONS
H T HOWARD 10/93

- THERE ARE SOME IMPORTANT THINGS TO LOOK FOR WHEN SELECTING A REFLECTOR

  A. IT MUST BE STRONGLY BUILT USING QUALITY MATERIALS

  B. THE SURFACE MUST BE SMOOTH AND HAVE SMALL HOLES IF IT IS A MESH OR PERFORATED TYPE

  C. THE FRONT SURFACE MUST BE FLAT WHEN SITED ACROSS OR TESTED USING STRINGS

- FIGURE 3 SHOWS TWO REFLECTORS OF DIFFERENT DEPTHS
- IT IS IMPORTANT TO KNOW THE RATIO OF THE FOCAL LENGTH TO THE DIAMETER, f/D, SO THAT THE FEED HORN CAN BE ADJUSTED
- A "FLAT" DISH - f/D OF 0.45 - REQUIRES THE FEED HORN TO ILLUMINATE A 117 DEGREE ARC
- A "DEEP" DISH - f/D OF 0.3 - REQUIRES A MUCH WIDER ANGLE - 161 DEGREES

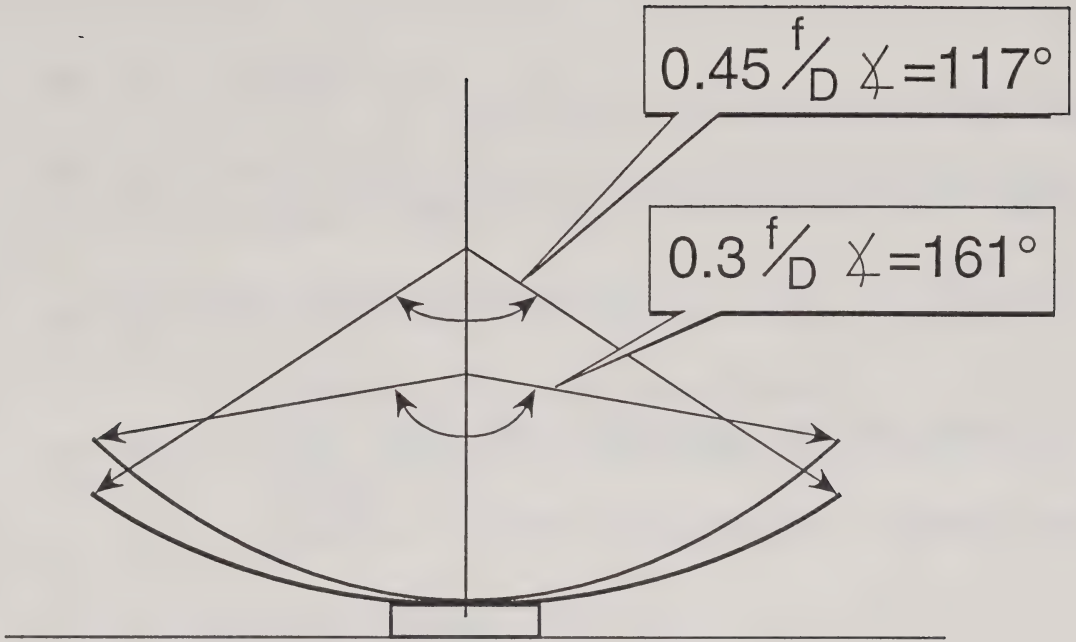

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FIGURE 3
PARABOLA ILLUMINATION ANGLE
H T HOWARD 10/93

- WHY CHOOSE ONE f/D OVER ANOTHER?

  A. DEEPER DISHES (0.3)

     SLIGHTLY MORE EFFICIENT - MORE GAIN, LESS NOISE.
     FEED MAY BE ADJUSTED TO MINIMIZE TERRESTRIAL INTERFERENCE

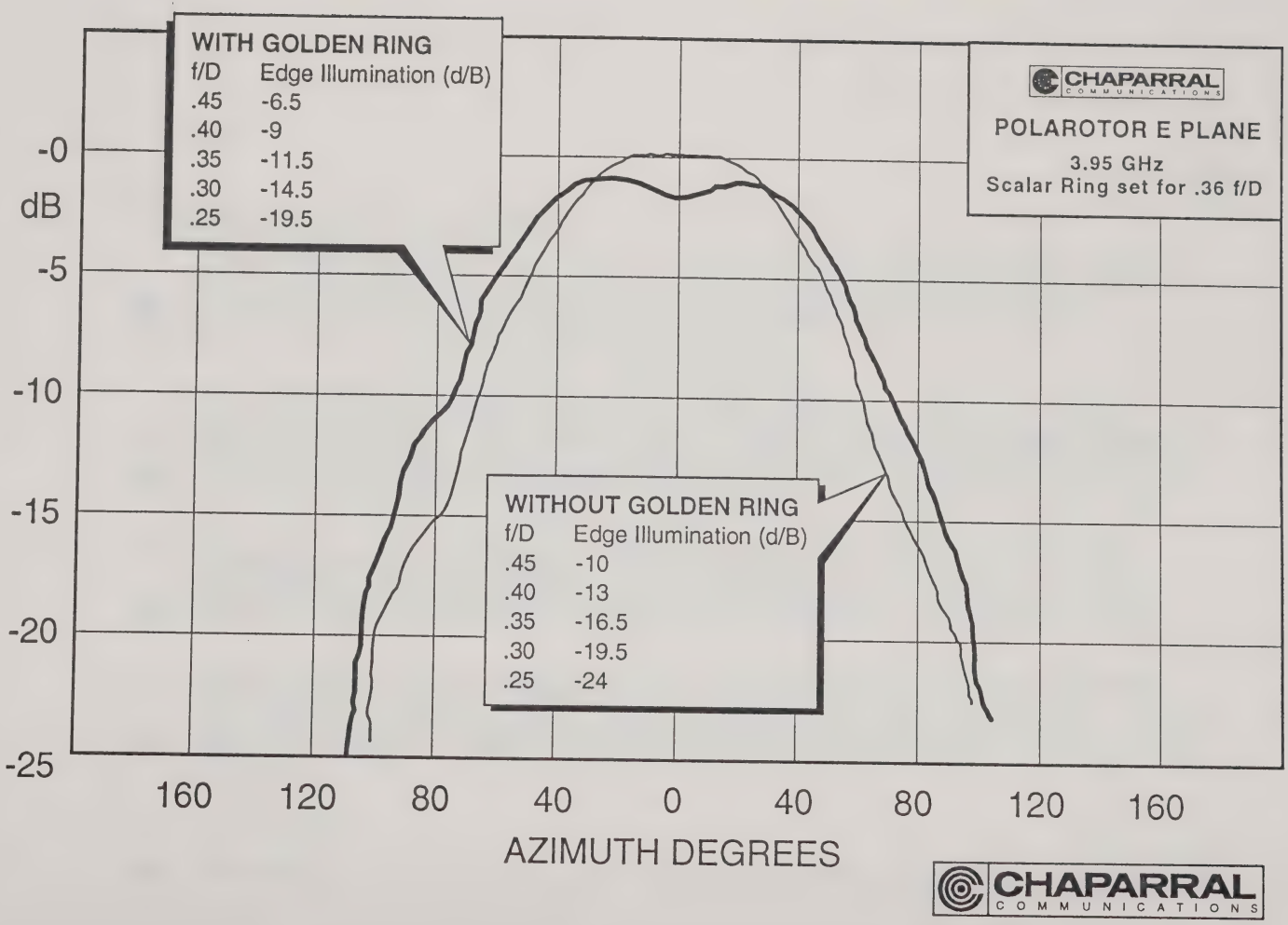
  B. FLATTER DISHES (0.45)

     LESS EXPENSIVE (LESS MATERIAL, LIGHTER WEIGHT).
     EASY TO ASSEMBLE IN FIELD (FLAT PANEL TYPES)

- IS THERE A "BEST" f/D?
- BEST FOR PERFORMANCE AND INTERFERENCE REJECTION 0.3
- BEST COST VERSUS PERFORMANCE TRADEOFF 0.35 TO 0.38
- COST, COST, COST 0.4 AND UP

- HOW DOES THE FEED HORN WORK?
- FIGURE 3 SHOWED THE WIDE RANGE OF ILLUMINATION ANGLES NEEDED
- THE HORN IS DESIGNED TO COLLECT THE MAXIMUM ENERGY FROM THE DISH CENTER
- IT SHOULD COLLECT VERY LITTLE ENERGY FROM OUTSIDE THE DISH
- THUS THE ILLUMINATION PATTERN IS TAPERED TO GET THE BEST GAIN AND MINIMUM NOISE FROM THE GROUND

- FIGURE 4 IS A TYPICAL CHAPARRAL POLAROTOR PATTERN
- THE BOTTOM AXIS SHOWS DEGREES OF ILLUMINATION ANGLE
- THE LEFT AXIS IS RESPONSE POWER. 10 dB IS 1/10 POWER AND 20 dB IS 1/100 POWER.
- THE FEED RESPONSE ANGLE IS SELECTED SO THAT THE EDGE OF THE REFLECTOR IS 10 TO 15 dB LESS ILLUMINATED THAN THE CENTER
- THIS IS DONE IN TWO WAYS - BY MOVING THE SCALAR PLATE AND BY ADDING THE GOLDEN RING FOR "DEEP" DISHES.



CHAPARRAL COMMUNICATIONS

FIGURE 4
TYPICAL POLAROTOR PATTERN
H T HOWARD 10/93

- WHEN THE FEED IS PROPERLY ADJUSTED FOR THE REFLECTOR f/D THE ANTENNA WILL:

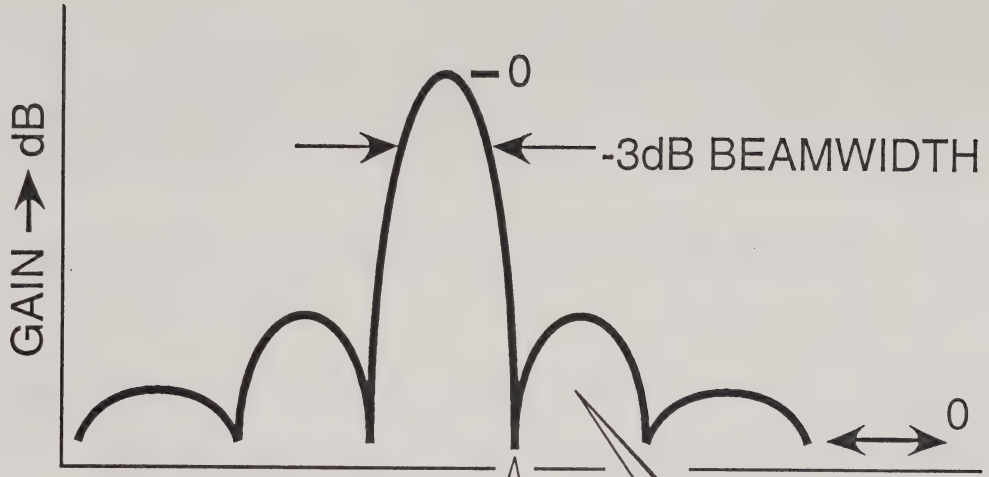
  BE 70 TO 75% EFFICIENT

  ADD ONLY 30 TO 40 KELVINS TO THE LNB TEMPERATURE

- FLAT PANEL MESH REFLECTORS WILL USUALLY BE ABOUT 65% EFFICIENT

- THE FEED CAN BE ADJUSTED TO "UNDER" ILLUMINATE A DEEP DISH TO MINIMIZE BOTH NOISE AND TERRESTRIAL INTERFERENCE

- FIGURE 5 SHOWS THE TYPICAL RESPONSE OF VARIOUS REFLECTOR SIZES
- THE LOWER AXIS IS THE BEAMWIDTH OF THE REFLECTOR
- THE LEFT AXIS IS GAIN
- NOTE THE CENTRAL, MAIN LOBE AND ITS 3 dB BEAMWIDTH
- ON EITHER SIDE OF THE MAIN LOBE ARE THE NULLS SIDE LOBES
- THE SIDE LOBES WILL TYPICALLY BE MORE THAN 18 dB DOWN FROM THE MAIN LOBE TO PREVENT INTERFERENCE FROM ADJACENT SATELLITES



DISH DIA	BEAMWIDTH	NULL	SIDELOBE
4'	4.2°	5.8°	7.3°
6'	2.7°	3.8°	4.8°
8'	2.2°	2.9°	3.6°
10'	1.7°	2.3°	2.9°
12'	1.4°	1.9°	2.4°
14'	1.25°	1.7°	2.1°
16'	1.1°	1.5°	1.8°

CHAPARRAL COMMUNICATIONS

FIGURE 5
ANTENNA BEAMWIDTHS
H T HOWARD 10/93

- INCREASING DISH SIZE DOES SEVERAL THINGS

  A. INCREASES GAIN

  B. DECREASES 3dB BEAMWIDTH

  C. MOVES THE NULLS AND SIDE LOBES IN CLOSER

  LARGER DISHES REQUIRE MUCH STRONGER MOUNTS FOR BOTH SURVIVAL AND ACCURATE POINTING

- FIGURE 6 - CARRIER TO NOISE RATIO, C/N, VERSUS DISH SIZE
- THE SATELLITE LINK EQUATION HAS BEEN USED TO GRAPHICALLY PRESENT ENOUGH INFORMATION TO SELECT DISH SIZE
- 5, 9, AND 13 dB C/N PRODUCE MARGINAL, GOOD AND PERFECT PICTURES, RESPECTIVELY
- THRESHOLD EXTENSION CAN BE USED TO IMPROVE MARGINAL PICTURES BY 2 TO 3 dB
- THRESHOLD EXTENSION DEGRADES GOOD TO PERFECT PICTURES

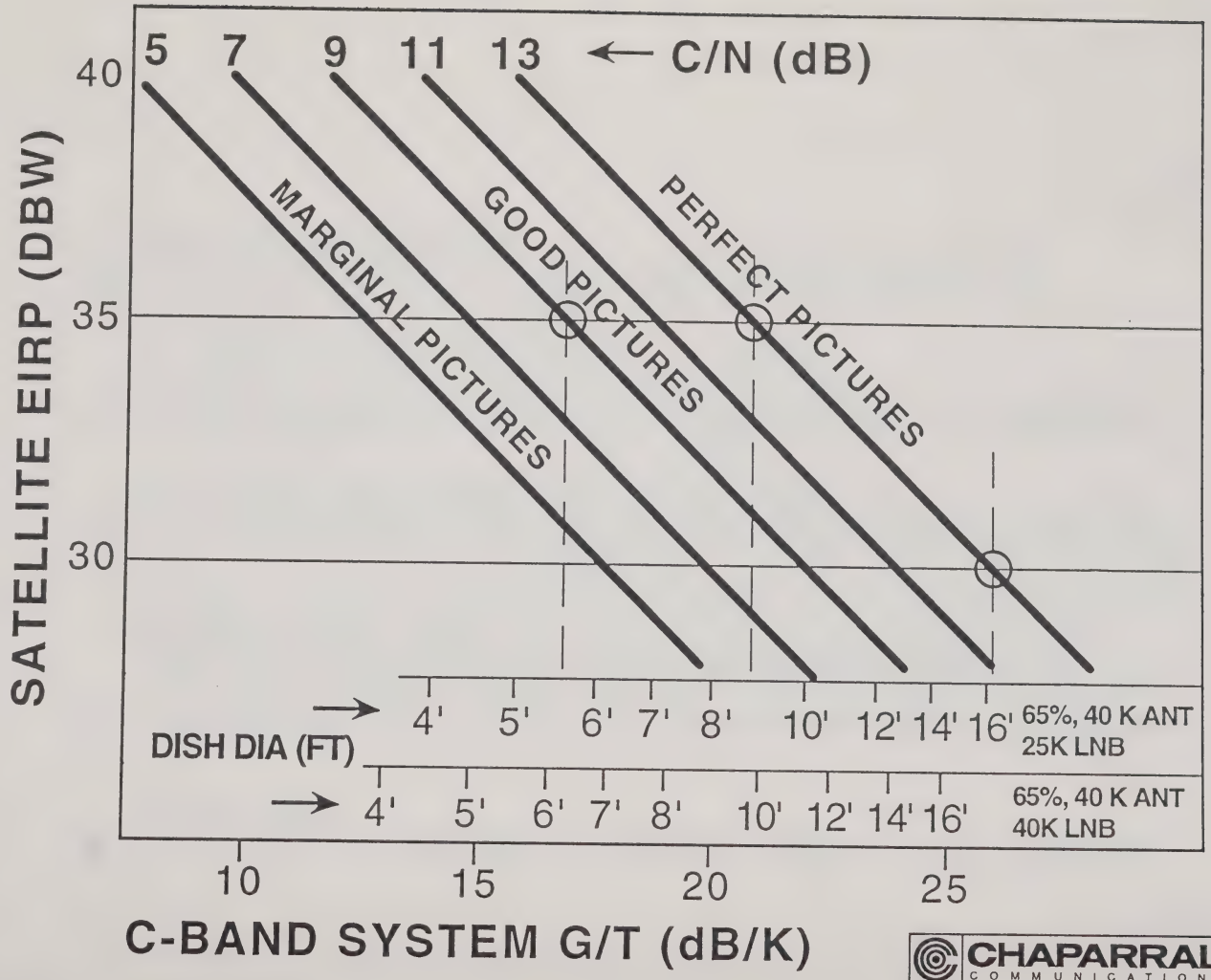


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FIGURE 6
C/N VS DISH SIZE
H T HOWARD 10/93

- INSTALLATION TIPS
- STRING THE DISH OR SITE ACROSS IT TO MAKE SURE IT IS FLAT
- SET THE SCALAR RING FOR THE DISH f/D - USE THE GOLDEN RING ON "DEEP" DISHES
- ORIENT THE FEED AND LNB TO 45 DEGREES FROM THE POLAR AXIS
- MAKE SURE THAT THE FEED IS IN THE CENTER OF THE DISH AND POINTED AT THE CENTER
- EXPERIMENT WITH THE DISH FOCAL POINT BY MOVING THE FEED IN AND OUT

SATELLITE TV ASIA 93 - PLENARY SESSION IV

ADVANCED TVRO & SMATV INSTALLATION TECHNIQUES

III. PORTABLE SPECTRUM ANALYSER (S-A) FOR SMATV & VSAT INSTALLS

A. WHAT IS A SPECTRUM ANALYSER?
B. CALIBRATION OF AMPLITUDE AND FREQUENCY
C. READING THE S-A DISPLAY
D. BANDWIDTH SETTINGS
E. SATELLITE ACQUISITION AND RECOGNITION
F. ANTENNA ALIGNMENT
G. IDENTIFICATION OF INTERFERENCE
H. FAULT FINDING
    a. DETECTING CABLE "TILT
    b. CABLE LOSS FACTORS
    c. COMPONENT PERFORMANCE
I. STORING SYSTEM PERFORMANCE MEASUREMENTS AS A TEMPLATE FOR MULTIPLE SYSTEM INSTALLATIONS IN A GIVEN LOCALITY
J. MAINTENANCE CHECKS USING STORED RESULTS OF INITIAL SYSTEM PERFORMANCE
K. CN/R MEASUREMENTS

SATELLITE TV ASIA 93 - PLENARY SESSION IV

ADVANCED TVRO & SMATV INSTALLATION TECHNIQUES

I. DISH ALIGNMENT TOOLS FOR ANTENNA TRACKING ALIGNMENT

A. USING THE ARC SET BUBBLE LEVELS AS A FOR AXIS, EXTREME AND ARC ZENITH SETTINGS
B. ESTABLISHING A TEMPLATE FOR MULTIPLE SYSTEM INSTALLATIONS IN A GIVEN LOCALITY

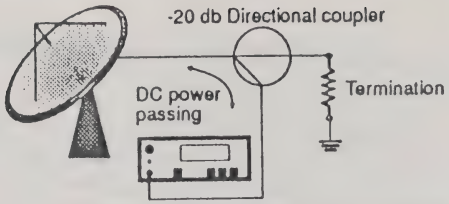
II. SIGNAL STRENGTH METERS

A. THE DIFFERENCE BETWEEN C AND KU-BAND ADJUSTMENTS
B. PEAKING ANTENNA TRACKING ALIGNMENT
C. PEAKING FOCAL LENGTH
D. PEAKING FEEDHORN AND/OR SCALAR RING PLACEMENT
E. USING THE AUDIO TONE PEAKING FEATURE

GS-1000 - ADVANCED TIPS

Extended input level:

Using a low cost directional coupler, the GS-1000 can easily accept input levels above its maximum of -25 dbm. To view levels up to a -5 dbm, use the circuit setup shown. Power must be able to pass up through the D.C. tap for the GS-1000 to drive the LNB. Use a 75 ohm termination resistor on the thru port (no DC pass).



Factory settings:

The GS-1000 ships with the following factory settings>

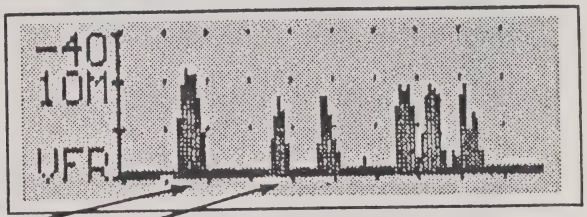
Oversample -	OFF
Detector mode -	Peak
IF BW -	Narrow
Frequency sweep -	Normal (950 to 1450 MHz)
Display grid -	ON

IF Bandwidth settings:

When using the GS-1000 on analog video applications only, you should leave the IF BW set to **'Wide'**. For VSAT, DBS, digital compression or any narrow band service work, such as T.I. surveys, set the configuration to **'Narrow'**. The narrow band setting is necessary for resolving multiple signals with close frequency spacing.

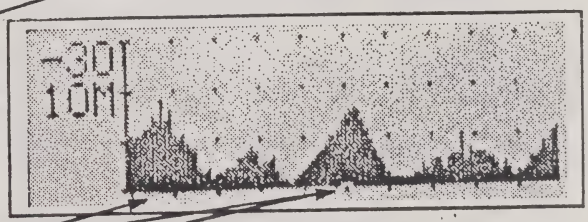
Example signals:

The GS-1000 displays spectral information in a way that appears different from other analog/CRT type analyzers. With experience using the GS-1000 you will learn to identify each type of signal you encounter. However, for those of you just getting started, a few example signals are shown.

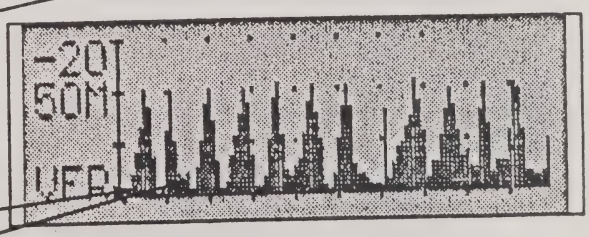


3.5 MHz wide(3 db) VSAT data carrier
2 MHz wide DBS (digital compression) carrier
The DBS signal level is at a -54 dbm

***TIP** - digital compression signals will display about the same amplitude in both **PEAK** and **AVERAGE** detector modes, analog video will show a drop in level in the **AVERAGE** detector mode



Various data transmissions
Very stable amplitude - ideal for peaking with the Tracking Marker (TKM)
***Note** that the on-screen marker is underneath the signal to be tracked



Regular analog video signal
analog video cross polarity signal

***Note** - cross pol is barely visible - to get a closer look, Zoom in (**ZMI**) and set (**ATT**) to ref -30 or -40 dbm

Satellite signatures:

To familiarize yourself with the various satellite signatures (the way signals appear on the spectrum display), you may wish to make notes of key features that differentiate each satellite. Missing transponders, amplitude levels and the combination of different types of transmissions are a few items to look for.

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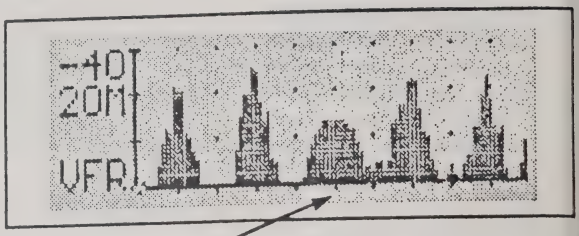
(see reverse side)

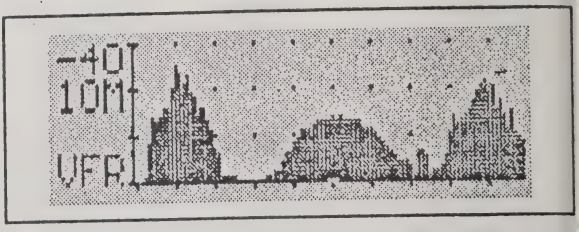
Examples of digitally compressed signals:

5/5/93:
On Galaxy 5 (TR-14), Viacom is testing an S-A Digital signal for The Movie Channel West feed and will eventually use this type of Digital Compression on TR-24 as well.



TR-14 is at frequency 1170 Mhz downconverted (3980 Mhz C-band). The GS-1000 was set for 20 Mhz/div and the top reference level is at -40 dbm. The level of the compressed signal reads -57 dbm.

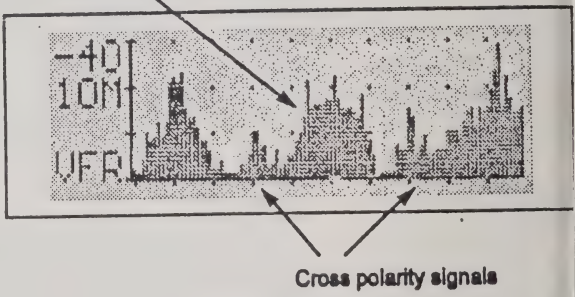
The other four signals present are regular analog video. A noticeable difference when viewing these two types of signals is that the analog video jumps up and down more than the stable amplitude of a digitally compressed signal.



This next "snap-shot" is of the same signal except at a narrower span setting (i.e. 10 Mhz/div). This is a good example of what the Zoom In (ZMI) function does. Note that the On-screen marker is now at 1170 Mhz, directly underneath the compressed signal. The Tracking Marker (TKM) could then be used at this point.

5/5/93:
On Satcom C3 (TR-9), you will find the Digital Cable Radio channel. The marker is at 1270 Mhz (3880 Mhz C-band). Other than the periodic spikes that move across the top of the transponder, there is very little difference to the digital video compression above.

Note: The cross polarity signal amplitudes shown are not optimum and should be nulled.



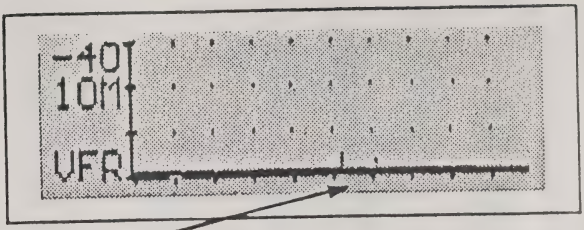
Currently, broadcasters are switching over some of their programming to digital compression. You can now find transponders using various types of compression on several satellites. At this time, GI (Digicipher), MPEG audio, CLI (Spectrum Saver) and S-A Digital are all being transmitted on a limited basis on a few satellites.

The Tracking Marker (TKM) was designed to work especially well with these forms of modulation. Take advantage of these signals when peaking your antenna or nulling cross polarity. In a short period of months, virtually all satellites will be transmitting some form of digitally compressed signal.

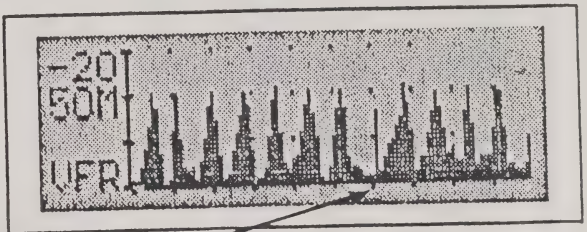
Advanced tips continued:

Spurious signals:

There are two types of spurious signals (spurs) that will be discussed here. Internal spurs that produce a reading on the LCD display screen even though no signal is supplied to the input is the first type. Although spurious signals in the GS-1000 are well suppressed, some units may display a small blip (a few db above the noise floor) This usually occurs when the unit is set to minimum attenuation (-40dbm ref), the IF BW is set to 'Wide' and the frequency range to 'Extended'. The most common spurs occur at 1488-1498 MHz. Any spurs found should be ignored and will not effect the accuracy of the unit.



All spectrum analyzers have some type of internal oscillator and therefore generate EMI (Electromagnetic Interference) in certain frequency bands. These emissions usually contain some frequency components in the 3.7 to 4.2 GHz (C-Band) range. When operating in close proximity to a satellite dish antenna, the LNB will invariably receive some of the EMI. This is due to the extreme sensitivity of the LNB and is similar to the way terrestrial interference is coupled into a system. This received EMI will show up on the LCD screen as a single blip at around 1310 MHz. This T.I. spike will not effect the accuracy of the GS-1000.



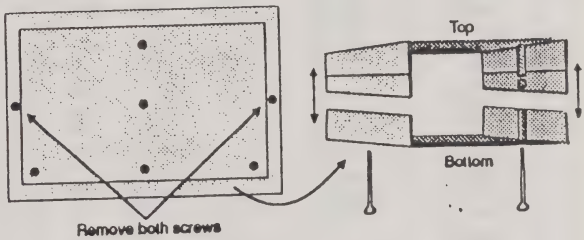
Replacing the batteries:

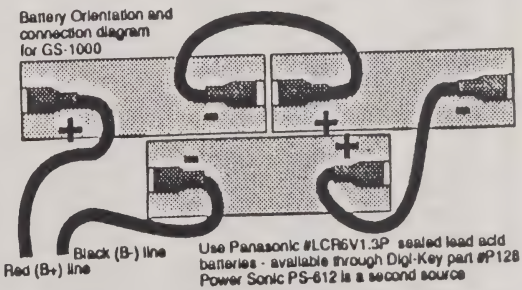
The GS-1000 internal battery pack will require replacing after several hundred discharge cycles. Frequency of replacement depends on usage, ambient temperature and the discharge depth.

For optimal battery durability, minimize the depth to which the 'battery level' drops and the total time that level remains low. When not using the GS-1000, the unit should be connected to the battery charger on float charge. To further maximize battery life, store the unit in a cool dry place when not in use. Avoid leaving the unit in environments above 120° F on a regular basis.

Batteries must be replaced by an authorized service center to prevent voiding the warranty. However, because the batteries will generally not need replacing until after your warranty has expired, some may wish to perform this operation themselves.

To replace the GS-1000 battery pack, remove the two bottom screws and carefully separate the top and bottom shells as shown in the diagram. The ABS plastic housing has an EMI coating on the inside which will cause the two halves to stick, this is normal. Do not push on the front plate during this procedure as it may jam into the unit and cause damage.





Disconnect the red (B+) line from the battery pack. Next, remove the rear plate and disconnect the black (B-) line. Exchange the batteries with compatible replacements (refer to diagram). Make sure batteries are connected by the two jumpers with proper polarity as shown. Reconnect the (B-) line, attach rear plate and reconnect the (B+) line. Finally, attach the top shell and replace the two bottom screws.

SATELLITE TV ASIA 93 - PLENARY SESSION IV

ADVANCED TVRO & SMATV INSTALLATION TECHNIQUES

SATELLITE MASTER ANTENNA TELEVISION (SMATV) SYSTEMS

I. SMATV INVOLVES TWO DISTINCT PARTS, THE HEADEND AND THE DISTRIBUTION SYSTEM

A. THE HEADEND - A QUESTION OF BALANCE
1. COMMERCIAL RECEIVERS AND DESCRAMBLERS
2. CHANNEL MODULATORS, VHF, UHF, MID-BAND
3. OFF-AIR CHANNELS, BAND PASS FILTERS, SINGLE CHANNEL AMPLIFIERS, FM RADIO
4. LOCAL ORIGINATION
   a) CAMERA
   b) MESSAGE GENERATORS, CRAWL LINE OR FULL SCREEN DISPLAY
5. COMBINERS, ACTIVE AND PASSIVE
6. DISTRIBUTION AMPLIFIERS
7. BALANCE, AUDIO BELOW VIDEO, USING A FIELD STRENGTH METER, QUAD SHIELD CABLE

ADVANCED TVRO & SMATV INSTALLATION TECHNIQUES

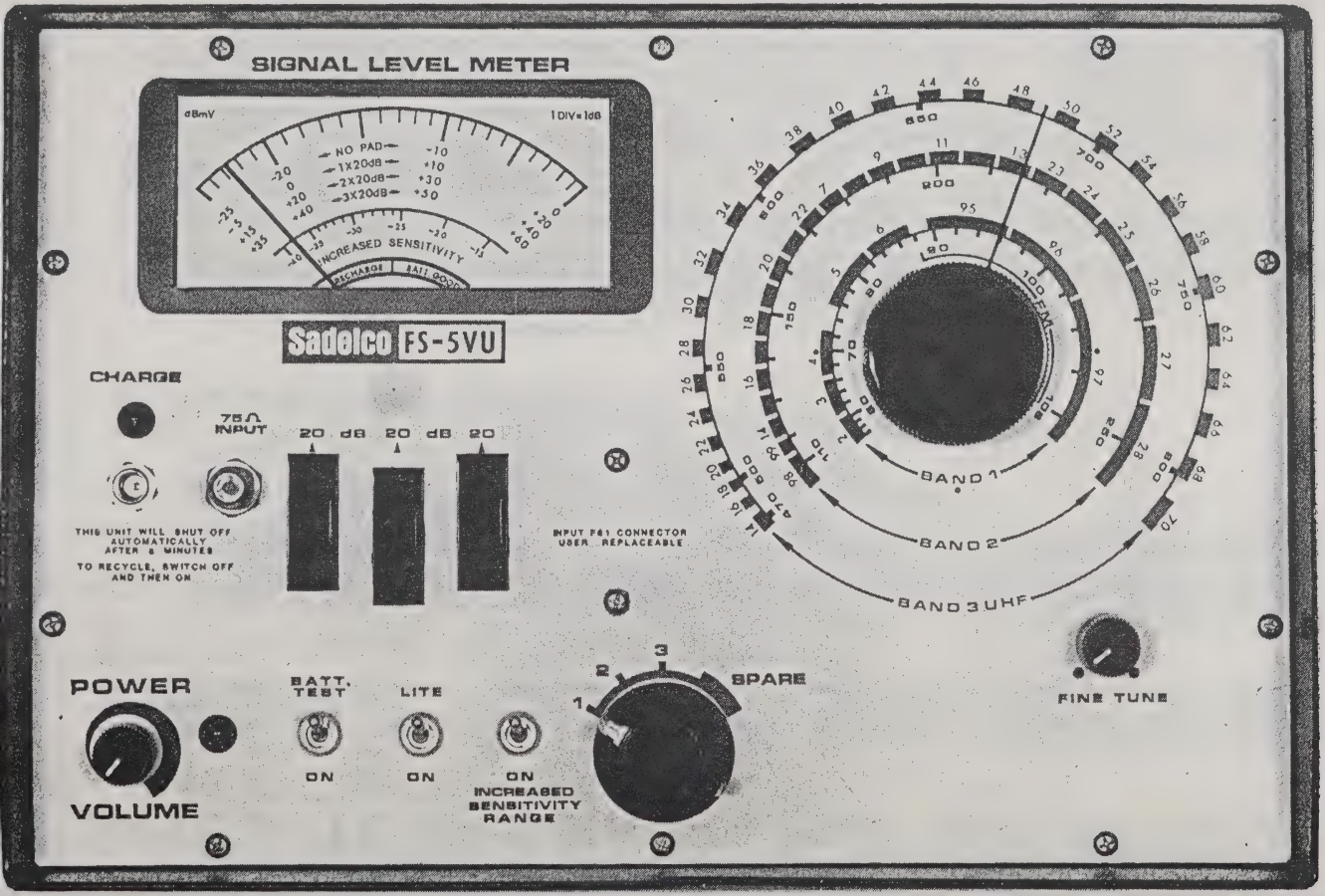
THE HEADEND DOES NOT CARE HOW BIG THE DISTRIBUTION SYSTEM IS BEYOND THIS POINT. CHECK A TV HERE, YOU CAN ONLY DISTRIBUTE WHAT YOU HAVE HERE. IT WILL NOT GET ANY BETTER!

B. THE DISTRIBUTION SYSTEM

1. MMDS OR CABLE
2. CABLE: CHECK TV RECEPTION ON EACH FLOOR BEFORE STARTING TO DETERMINE IF EXISTING MATV SYSTEM WILL WORK. WILL CABLE BE OVERHEAD OR BURIAL?
3. MAP OUT SYSTEM SHOWING PLACEMENT OF SPLITTERS, TAPS, AMPLIFIERS, AND LENGTH OF CABLE RUNS. FIVE TO TEN (5-10) DB REQUIRED AT EACH TV. FIGURE CABLE ATTENUATION LOSS, INSERTION LOSS OF CONNECTORS AND PASSIVE DEVICES. FIGURE OUT TAP VALUES AND PLACEMENT OF AMPLIFIERS.
3. HOTELS: PAY PER VIEW, ADDRESSABLE CONVERTER BOXES REQUIRED?
4. APARTMENTS: POSITIVE OR NEGATIVE TRAPS REQUIRED? CABLE CONVERTER BOX REQUITED?

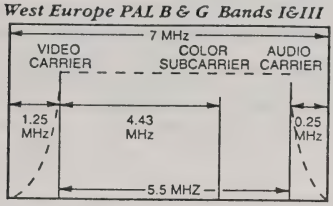
Sadelco FS5UV Signal Level Meters

Designed for the Budget Conscious Installer and Technician



International Television Frequencies in MHz

West Europe PAL B & G Bands I&III

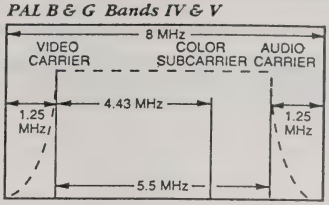


CH	Band Width	Carriers Video	Audio
IF		38.90	33.40
E2	47	54 ..... 48.25	53.75
E3	54	61 ..... 55.25	60.75
E4	61	68 ..... 62.25	67.75
X	68	75 ..... 69.25	74.75
Y	75	82 ..... 76.25	81.75
Z	82	89 ..... 83.25	88.75
S3	118	125 ..... 119.25	124.75
S4	125	132 ..... 126.25	131.75
S5	132	139 ..... 133.25	138.75
S6	139	146 ..... 140.25	145.75
S7	146	153 ..... 147.25	152.75
S8	153	160 ..... 154.25	159.75
S9	160	167 ..... 161.25	166.75
S10	167	174 ..... 168.25	173.75
E5	174	181 ..... 175.25	180.75
E6	181	188 ..... 182.25	187.75
E7	188	195 ..... 189.25	194.75
E8	195	202 ..... 196.25	201.75
E9	202	209 ..... 203.25	208.75
E10	209	216 ..... 210.25	215.75
E11	216	223 ..... 217.25	222.75
E12	223	230 ..... 224.25	229.75
S11	230	237 ..... 231.25	236.75
S12	237	244 ..... 238.25	243.75
S13	244	251 ..... 245.25	250.75
S14	251	258 ..... 252.25	257.75
S15	258	265 ..... 259.25	264.75
S16	265	272 ..... 266.25	271.75
S17	272	279 ..... 273.25	278.75
S18	279	286 ..... 280.25	285.75
S19	286	293 ..... 287.25	292.75
S20	293	300 ..... 294.25	299.75

PAL B & G Bands IV & V

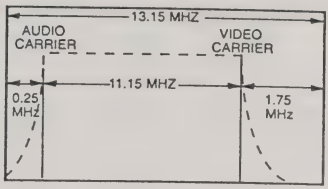
S21	302	310 ..... 303.25	308.75
S22	310	318 ..... 311.25	316.75
S23	318	326 ..... 319.25	324.75
S24	326	334 ..... 327.25	332.75
S25	334	342 ..... 335.25	340.75
S26	342	350 ..... 343.25	348.75
S27	350	358 ..... 351.25	356.75
S28	358	366 ..... 359.25	364.75
S29	366	374 ..... 367.25	372.75
S30	374	382 ..... 375.25	380.75
S31	382	390 ..... 383.25	388.75
S32	390	398 ..... 391.25	396.75
S33	398	406 ..... 399.25	404.75
S34	406	414 ..... 407.25	412.75
S35	414	422 ..... 415.25	420.75
S36	422	430 ..... 423.25	428.75
S37	430	438 ..... 431.25	436.75
S38	438	446 ..... 439.25	444.75
S39	446	454 ..... 447.25	452.75

PAL B & G Bands IV & V



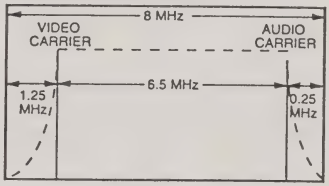
CH	Band Width	Carriers Video	Audio
S40	454	462 ..... 455.25	460.75
S41	462	470 ..... 463.25	468.75
21	470	478 ..... 471.25	476.75
22	478	486 ..... 479.25	484.75
23	486	494 ..... 487.25	492.75
24	494	502 ..... 495.25	500.75
25	502	510 ..... 503.25	508.75
26	510	518 ..... 511.25	516.75
27	518	526 ..... 519.25	524.75
28	526	534 ..... 527.25	532.75
29	534	542 ..... 535.25	540.75
30	542	550 ..... 543.25	548.75
31	550	558 ..... 551.25	556.75
32	558	566 ..... 559.25	564.75
33	566	574 ..... 567.25	572.75
34	574	582 ..... 575.25	580.75
35	582	590 ..... 583.25	588.75
36	590	598 ..... 591.25	596.75
37	598	606 ..... 599.25	604.75
38	606	614 ..... 607.25	612.75
39	614	622 ..... 615.25	620.75
40	622	630 ..... 623.25	628.75
41	630	638 ..... 631.25	636.75
42	638	646 ..... 639.25	644.75
43	646	654 ..... 647.25	652.75
44	654	662 ..... 655.25	660.75
45	662	670 ..... 663.25	668.75
46	670	678 ..... 671.25	676.75
47	678	686 ..... 679.25	684.75
48	686	694 ..... 687.25	692.75
49	694	702 ..... 695.25	700.75
50	702	710 ..... 703.25	708.75
51	710	718 ..... 711.25	716.75
52	718	726 ..... 719.25	724.75
53	726	734 ..... 727.25	732.75
54	734	742 ..... 735.25	740.75
55	742	750 ..... 743.25	748.75
56	750	758 ..... 751.25	756.75
57	758	766 ..... 759.25	764.75
58	766	774 ..... 767.25	772.75
59	774	782 ..... 775.25	780.75
60	782	790 ..... 783.25	788.75
61	790	798 ..... 791.25	796.75
62	798	806 ..... 799.25	804.75
63	806	814 ..... 807.25	812.75
64	814	822 ..... 815.25	820.75
65	822	830 ..... 823.25	828.75
66	830	838 ..... 831.25	836.75
67	838	846 ..... 839.25	844.75
68	846	854 ..... 847.25	852.75
69	854	862 ..... 855.25	860.75

French E



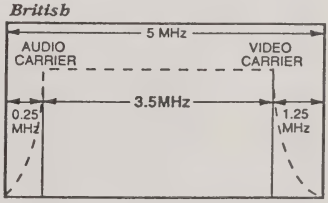
CH	Band Width	Carriers Video	Audio
2	41.0	54.15 ..... 52.40	41.25
4	54.15	67.3 ..... 65.55	54.40
5	162.25	175.15 ..... 164.00	175.15
6	162.0	175.15 ..... 173.40	162.25
7	175.4	188.55 ..... 177.15	188.30
8A	174.0	188.0 ..... 185.25	174.10
8	175.15	188.3 ..... 186.55	175.40
9	188.55	201.7 ..... 190.30	201.45
10	188.3	201.45 ..... 199.70	188.55
11	201.7	214.85 ..... 203.45	214.60
12	201.45	214.6 ..... 212.85	201.70

French L Bands I & III



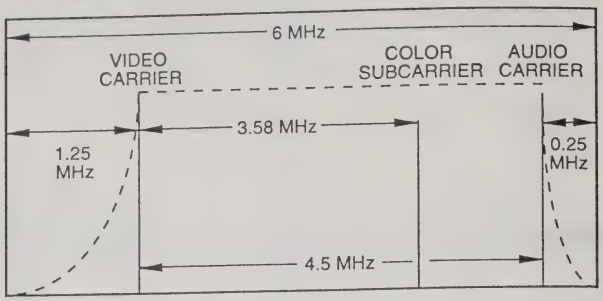
CH	Band Width	Carriers Video	Audio
2	49.0	57.0 ..... 55.75	49.25
3	53.75	61.75 ..... 60.5	54.0
4	57.0	65.0 ..... 63.75	57.25
5	174.75	182.75 ..... 176.0	182.5
6	182.75	190.75 ..... 184.0	190.5
7	190.75	198.75 ..... 192.0	198.5
8	198.75	206.75 ..... 200.0	206.5
9	206.75	214.75 ..... 208.0	214.5
10	214.75	222.75 ..... 216.0	222.5

Britisb



CH	Band Width	Carriers Video	Audio
1	41.25	46.25 ..... 45.00	41.50
2	48.0	53.0 ..... 51.75	48.25
3	53.0	58.0 ..... 56.75	53.25
4	58.0	63.0 ..... 61.75	58.25
5	63.0	68.0 ..... 66.75	63.25
6	176.0	181.0 ..... 179.75	176.25
7	181.0	186.0 ..... 184.75	181.25
8	186.0	191.0 ..... 189.75	186.25
9	191.0	196.0 ..... 194.75	191.25
10	196.0	201.0 ..... 199.75	196.25
11	201.0	206.0 ..... 204.75	201.25
12	206.0	211.0 ..... 209.75	206.25
13	211.0	216.0 ..... 214.75	211.25
14	216.0	221.0 ..... 219.75	216.25

North American Television Frequencies in MHz



SUB-BAND

Channel	Band Width	Carriers Video	Audio
T-7	5.75	11.75	7	11.5
T-8	11.75	17.75	13	17.5
T-9	17.75	23.75	19	23.5
T-10	23.75	29.75	25	29.5
T-11	29.75	35.75	31	35.5
T-12	35.75	41.75	37	41.5
T-13	41.75	47.75	43	47.5

TV-IF 40 ... 46 ... 45.75 ... 41.25

Low Band

CH	Band Width	Carriers Video	Audio
2	54	60	55.25	59.75
3	60	66	61.25	65.75
4	66	72	67.25	71.75
54 IRC	72	78	73.25	77.25
5	76	82	77.25	81.75
55 IRC	78	84	79.25	83.75
6	82	88	83.25	87.75
56 IRC	84	90	85.25	89.75

FM

57 I A-5	90	96	91.25	95.75
58 I A-4	96	102	97.25	101.75
59 I A-3	102	108	103.25	107.75
98 A-2	108	114	109.275	113.775
99 A-1	114	120	115.275	119.775

Mid-Band

14 A	120	126	121.2625	125.7625
15 B	126	132	127.2625	131.7625
16 C	132	138	133.2625	137.7625
17 D	138	144	139.25	143.75
18 E	144	150	145.25	149.75
19 F	150	156	151.25	155.75
20 G	156	162	157.25	161.75
21 H	162	168	163.25	167.75
22 I	168	174	169.25	173.75

Hi Band

7	174	180	175.25	179.75
8	180	186	181.25	185.75
9	186	192	187.25	191.75
10	192	198	193.25	197.75
11	198	204	199.25	203.75
12	204	210	205.25	209.75
13	210	216	211.25	215.75

Super-Band

23 J	216	222	217.25	221.75
24 K	222	228	223.25	227.75
25 L	228	234	229.2625	233.7625
26 M	234	240	235.2625	239.7625
27 N	240	246	241.2625	245.7625
28 O	246	252	247.2625	251.7625
29 P	252	258	253.2625	257.7625
30 Q	258	264	259.2625	263.7625
31 R	264	270	265.2625	269.7625
32 S	270	276	271.2625	275.7625
33 T	276	282	277.2625	281.7625
34 U	282	288	283.2625	287.7625
35 V	288	294	289.2625	293.7625
36 W	294	300	295.2625	299.7625

Hyper-Band

CH	Band Width	Carriers Video	Audio
37 AA	300	306	301.2625	305.7625
38 BB	306	312	307.2625	311.7625
39 CC	312	318	313.2625	317.7625
40 DD	318	324	319.2625	323.7625
41 EE	324	330	325.2625	329.7625
42 FF	330	336	331.275	335.775
43 GG	336	342	337.2625	341.7625
44 HH	342	348	343.2625	347.7625
45 II	348	354	349.2625	353.7625
46 JJ	354	360	355.2625	359.7625
47 KK	360	366	361.2625	365.7625
48 LL	366	372	367.2625	371.7625
49 MM	372	378	373.2625	377.7625
50 NN	378	384	379.2625	383.7625
51 OO	384	390	385.2625	389.7625
52 PP	390	396	391.2625	395.7625
53 QQ	396	402	397.2625	401.7625
54 RR	402	408	403.25	407.75
55 SS	408	414	409.25	413.75
56 TT	414	420	415.25	419.75
57 UU	420	426	421.25	425.75
58 VV	426	432	427.25	431.75
59 WW	432	438	433.25	437.75
60 XX	438	444	439.25	443.75
61 YY	444	450	445.25	449.75
62 ZZ	450	456	451.25	455.75

UHF Band

14	470	476	471.25	475.75
15	476	482	477.25	481.75
16	482	488	483.25	487.75
17	488	494	489.25	493.75
18	494	500	495.25	499.75
19	500	506	501.25	505.75
20	506	512	507.25	511.75
21	512	518	513.25	517.75
22	518	524	519.25	523.75
23	524	530	525.25	529.75
24	530	536	531.25	535.75
25	536	542	537.25	541.75
26	542	548	543.25	547.75
27	548	554	549.25	553.75
28	554	560	555.25	559.75
29	560	566	561.25	565.75
30	566	572	567.25	571.75
31	572	578	573.25	577.75
32	578	584	579.25	583.75
33	584	590	585.25	589.75
34	590	596	591.25	595.75

Channel	Band Width	Carriers Video	Audio
35	596	602	597.25	601.75
36	602	608	603.25	607.75
37	608	614	609.25	613.75
38	614	620	615.25	619.75
39	620	626	621.25	625.75
40	626	632	627.25	631.75
41	632	638	633.25	637.75
42	638	644	639.25	643.75
43	644	650	645.25	649.75
44	650	656	651.25	655.75
45	656	662	657.25	661.75
46	662	668	663.25	667.75
47	668	674	669.25	673.75
48	674	680	675.25	679.75
49	680	686	681.25	685.75
50	686	692	687.25	691.75
51	692	698	693.25	697.75
52	698	704	699.25	703.75
53	704	710	705.25	709.75
54	710	716	711.25	715.75
55	716	722	717.25	721.75
56	722	728	723.25	727.75
57	728	734	729.25	733.75
58	734	740	735.25	739.75
59	740	746	741.25	745.75
60	746	752	747.25	751.75
61	752	758	753.25	757.75
62	758	764	759.25	763.75
63	764	770	765.25	769.75
64	770	776	771.25	775.75
65	776	782	777.25	781.75
66	782	788	783.25	787.75
67	788	794	789.25	793.75
68	794	800	795.25	799.75
69	800	806	801.25	805.75
70	806	812	807.25	811.75
71	812	818	813.25	817.75
72	818	824	819.25	823.75
73	824	830	825.25	829.75
74	830	836	831.25	835.75
75	836	842	837.25	841.75
76	842	848	843.25	847.75
77	848	854	849.25	853.75
78	854	860	855.25	859.75
79	860	866	861.25	865.75
80	866	872	867.25	871.75
81	872	878	873.25	877.75
82	878	884	879.25	883.75
83	884	890	885.25	889.75

Channels requiring FCC Docket 21006 Offsets are shown with a positive offsets

TIMES FIBER DROP CABLE

ATTENUATION SUMMARY (dB per 100 feet)

Frequency (MHz)	59 Series Maximum	6 Series Maximum	611 Series Maximum	11 Series Maximum
5	0.79	0.58	0.51	0.35
30	1.42	1.10	0.96	0.73
50	1.72	1.36	1.21	0.90
108	2.44	2.01	1.67	1.28
216	3.48	2.86	2.39	1.83
240	3.67	3.02	2.53	1.94
270	3.90	3.21	2.69	2.07
300	4.12	3.39	2.84	2.19
325	4.29	3.53	2.96	2.28
350	4.46	3.67	3.08	2.38
375	4.62	3.80	3.20	2.47
400	4.78	3.93	3.31	2.55
450	5.07	4.18	3.52	2.72
500	5.37	4.41	3.72	2.88
550	5.65	4.64	3.92	3.04
600	5.93	4.85	4.11	3.18

At 68° F with +1% per +10° F Variance

ATTENUATION SUMMARY (dB per 100 meters)

Frequency (MHz)	59 Series Maximum	6 Series Maximum	611 Series Maximum	11 Series Maximum
5	2.59	1.90	1.67	1.15
30	4.66	3.61	3.15	2.39
50	5.64	4.46	3.97	2.95
108	8.01	6.59	5.48	4.20
216	11.4	9.38	7.84	6.00
240	12.0	9.91	8.30	6.36
270	12.8	10.5	8.82	6.79
300	13.5	11.1	9.32	7.18
325	14.1	11.6	9.71	7.48
350	14.6	12.0	10.1	7.81
375	15.2	12.5	10.5	8.10
400	15.7	12.9	10.9	8.36
450	16.6	13.7	11.6	8.92
500	17.6	14.5	12.2	9.45
550	18.5	15.2	12.9	9.97
600	19.5	15.9	13.5	10.4

At 20° C with +1.8% per +10° C Variance

Tracking Procedures

Now is the time to begin tracking the satellites and programming their positions into memory. This is not difficult now that you have everything set. When moving the dish to the east or west, the dish's look angle should now follow a curve similar to that of the Clarke Orbit.

You may have a satellite receiver that was designed to find and program the satellites on its own. However, even these "smart" receivers will require you to find and identify one upper and one lower satellite. There also are automatic dish peaking and polarity peaking features on some receivers. If you choose to use these auto features, first follow the steps below to get your dish to track the Clarke Orbit. Once you are confident that you are receiving your best signal on a lower and upper satellite and have programmed them into the receiver, you are ready to turn on the auto program feature.

The accuracy of these auto features primarily depends on which brand of receiver you have purchased. Some receivers occasionally miss a satellite or two and you often find that you can peak the position of the dish and polarity better manually. We recommend, especially during the initial installation, that you turn these features off.

Many receivers have a scanning feature that is handy for locating satellites. These receivers scan repeatedly through all the available channels at a rapid pace, providing you with glimpses of the active transponders. Channels will flash by on your TV screen as you move the dish past a satellite. You can go back to where the flashes occurred, turn off the scan feature, and identify the satellite by comparing the programming to a recent satellite TV guide's listings. Some satellites only carry a few active transponders. Without the scan feature, you would need to select an active transponder and tune to the correct polarization before you could find the satellite.

Preview the sections in your receiver manual on dish set-up and programming. Also read through these next steps to get familiar with the overall procedure you are about to perform. Finally, initiate each of the steps below.

Inclinometer readings for the satellite look angles (the elevations of the satellites available in your area) should be taken on the back plate of the antenna or on a surface parallel to the plane of the rim of the dish.

1.) Determine the elevation of the lowest satellite available from your location and move the dish until the inclinometer registers that elevation.

2.) Engage the receiver's scan feature or set the receiver to a channel which should have programming on it. A 24 hour service, even if it is scrambled, would be a good choice. Refer to a current satellite program guide to find a suitable selection.

3.) Push the dish to the right or left so that it rotates on the pole until you see a flash of video on your TV screen. Turn off the scan and go through the channels until you find video.

If the video seems to zip off the screen as soon as you stop on the channel, try changing the receiver's polarization format. That is, if you have your odd channels set for vertical polarization and your evens for horizontal, change the format to odds-horizontal, evens-vertical. You may not even know the present polarization format for your system. A change in format changes the relationship of the feedhorn's pick-up probe by 90 degrees. If changing the format keeps the video on the screen, then it has to be the correct setting for that satellite on your system.

Select the best skew setting for the odd and even channels. The skew and format buttons are found either on the front of the receiver or on the remote control. Many receivers with on-screen graphics require you to choose these functions on the menu.

Most receivers have a LED signal level indicator on the front panel or a digital level indicator presented by on-screen graphics. The level indicator provides a better reading of peak satellite perfomance in contrast to just viewing the picture on the TV screen.

4.) For locating satellites in the lower section of the Clarke Orbit, push the dish right and left on the pole and move the drive east and west in slight increments until you are satisfied you have the strongest signal. Then snug the mount's bolts onto the pole so that the dish won't rotate. Do not tighten them down firmly yet, however. Note the numerical reading provided on the receiver's front panel or on-screen display that corresponds to dish position at this location. This is a relative number that changes as the dish moves.

5.) Move the dish east or west until you reach arc zenith for your location. Select an active transponder for the satellite closest to the east or west of arc zenith or turn the scan control on. Now move the dish in the direction of the nearest satellite. If all the settings have been done right you should not have a problem finding it.

6.) For locating satellites that are in the upper section of the Clarke Orbit, jog the actuator drive east and west and adjust the elevation bracket (on the mount of the dish) up and down slightly. You should not have to move the elevation setting very much because you already have pre-set it for your location. The rule of thumb here is:

Rotate the dish on the pole and use the actuator to receive lower satellites, but do not rotate the dish on the pole to receive upper satellites. Adjust the elevation of the dish and use the actuator to receive upper satellites, but do not adjust the elevation to receive lower satellites.

7.) Fine tune your tracking by repeating these steps until the satellites in both the upper and lower sections of the Clarke Orbit appear at their maximum signal strength without requiring any further adjustments. If this cannot be done, you have probably made a miscalculation in the elevation or declination settings. Once you have the dish tracking properly, firmly snug the bolts that secure the mount onto the pipe. Placing a bolt all the way through the pipe may be desirable in high wind areas. Mark the pole and the mount for later reference.

A Quick and Easy Guide to Fixed Dish Installations

With the proper tools and a modicum of enthusiasm and effort, it should not be difficult for the do-it-yourselfer to install a fixed satellite antenna for receiving an individual satellite or multiple satellites such as the Astra bird which are collocated at a single orbital position. In many cases, the most important step will be to select and install the appropriate antenna mount for your particular location and living situation.

Selecting the Mount. Mounts are manufactured to accommodate a variety of possible placements such as on the ground, attached to an outside wall, or under the eve of the house. Roof mounts are available that either penetrate the surface of the roof and attach to the building's rafters or mount directly on the top of a flat roof. Above all, select the type of mount which can be installed where the antenna will have a clear and unobstructed view of the satellite of choice throughout the year.

Attaching the Antenna to the Mount. Once you have securely fastened the antenna's mount to the building or a supporting pole, mount the antenna as indicated in the directions. Do not fully tighten down those bolts which anchor the antenna at a specific position of elevation and azimuth until you have adjusted the antenna pointing to maximize your signal reception. Mount the feedhorn and LNB onto the feed support supplied with the antenna.

Running the Cables. A coaxial cable for the LNB will have to be installed between the receiver's location in the home and the feedhorn and LNB out at the antenna. Systems dedicated to the reception of satellites using two senses of polarization to transmit TV signals (such as the Astra and EUTELSAT satellites) also will require a two- or three-wire cable to connect the feedhorn's polarization connections to the receiver. Cable clips can be used to fasten these cables to the side of the building. Run the cable a bit below and then back up to the hole into the building thus providing a "drip loop" to prevent rain from running down the cable and into the building. Crimp type "F" connectors on each end of the coaxial cable.

The power for the LNB is also supplied by this coaxial line. Whenever you plug the receiver into the home's a.c. wall receptacle, electricity is being sent up this line. To avoid a short circuit that would blow the receiver's fuse or circuit breaker or even damage the LNB, always unplug the receiver whenever connecting or disconnecting the system's coaxial cable.

Peaking Antenna Performance. Before connecting the cable to the LNB, determine which method you will use to accurately aim the antenna at the satellite of choice. One method is to view the available TV services from this satellite while adjusting the antenna's alignment. You can then fine tune antenna pointing until all stray impulse noise or "sparklies" have been eliminated for all available channels. You can get close to maximum system performance using this method.

To totally peak system performance, however, you will need to use some kind of signal meter to ensure that the highest signal levels possible are obtained. Rain, fog, and snow can reduce the amount of Ku-band signals reaching your antenna. If you tune your antenna by watching the TV screen you may receive a wonderful picture at the time of installation—when there may be enough signal to exceed the receiver's threshold rating—but subsequently lose some picture quality whenever bad weather occurs. Likewise the meters on the receivers are not as sensitive as external peaking meters. That is why it is so important to peak system performance at the outset, so that the amount of signal reaching the receiver exceeds the unit's threshold level. This signal margin will then be there to compensate for any degradation of signal which occurs during adverse weather conditions.

The front of the receiver may have a signal level meter, an LED signal level display, or an on-screen graphic which displays relative signal strength. Any of these signal strength indicators can be used to peak your signal reception if the receiver (or TV in the case of an on-screen graphic signal indicator) can be moved into a position which can be viewed from the antenna. The receiver and TV set often are brought outside for this purpose—especially when peaking an antenna that is mounted on the ground or a flat roof. If you decide to move the receiver and TV outside, an extra length of coax and LNB/feedhorn cable will

be needed to temporarily connect the receiver to the feed and LNB.

It is impractical, however, to lug the receiver and/or TV up a ladder to peak an antenna mounted on the side of a building or under the eave. In this case it would be best to acquire an in-line, signal-strength meter for performing this task. What's more, a dedicated signal-strength meter also will be more accurate and sensitive than any meter supplied by your satellite TV receiver. Best of all, some portable meters provide an audio tone which increases in pitch as the signal becomes stronger. As you adjust the antenna slightly to the right/left and up/down, the audio tone will assist you in finding the ideal antenna pointing.

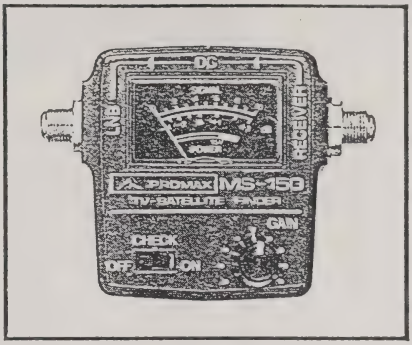


Fig. 7-10. An inexpensive signal meter with audio indicator. (Courtesy Promax.)

One word of caution concerning the use of a signal strength meter: you must always be sure that you are receiving the correct satellite before you begin using the meter. There are many satellites serving Europe these days, and you don't want to do a lot of work only to find that you are anchored onto the wrong bird! Scan through the available channels at the beginning, and again at the end, of the installation process to ensure that you are indeed getting the right satellite TV services.

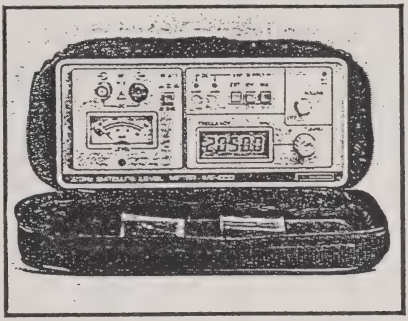


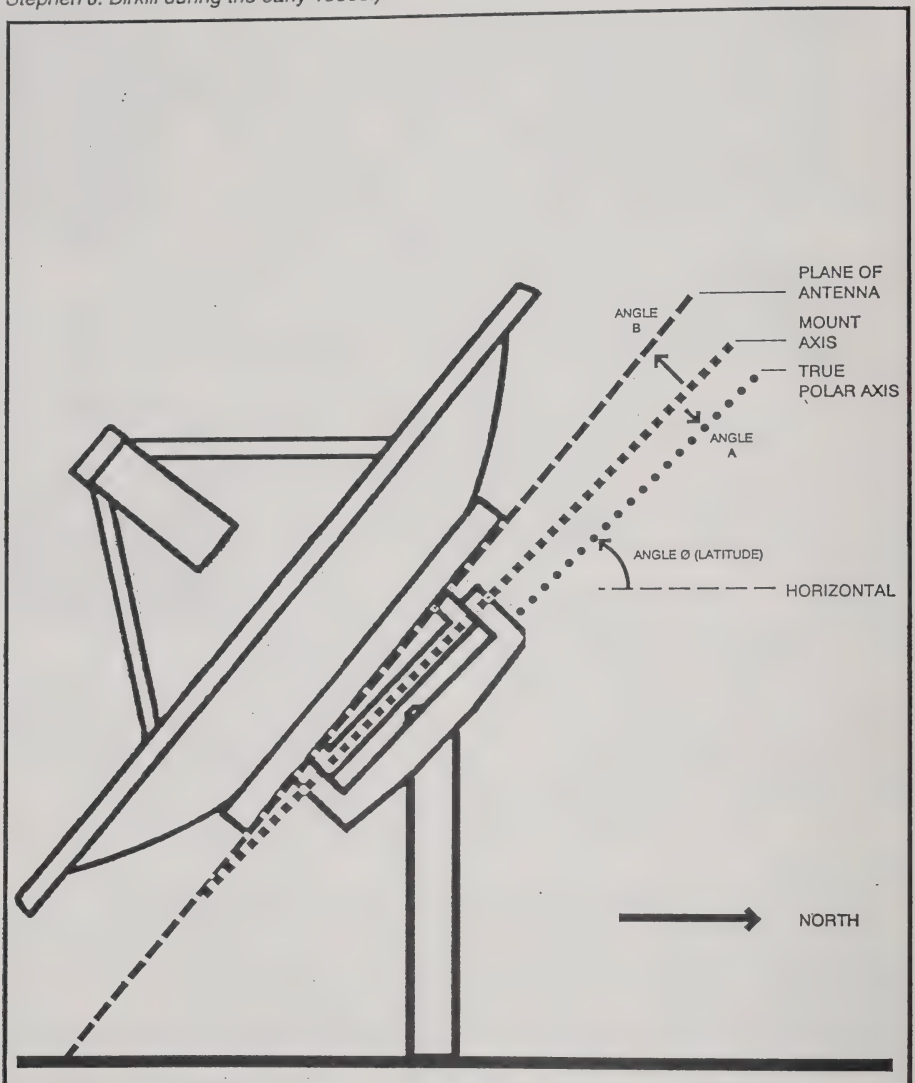
Fig. 7-11. A technician's satellite level meter incorporating advanced functions such as a digital IF frequency readout and LNB voltage supply. (Courtesy Promax.)

The signal strength meter may even supply the 12 volts needed to power up the LNB and therefore can connect directly to the LNB. Signal meters which do not supply power to the LNB will have to be inserted in the coaxial line running from the receiver to the LNB using a coaxial jumper cable. This tap supplies three connectors: one connects to the LNB, the second connects to the receiver, and the third supplies the connection that allows the meter to "tap" into the line and make the required signal strength measurements. Once you have completed the antenna alignment, you can tighten down all of the mounting bolts to prevent strong winds or rain from repointing the antenna for you.

Setting the Polarization. The feedhorn support which comes with the antenna holds the feedhorn and LNB at a fixed position towards the front of the antenna. If this support has an adjustment for setting the distance between the feedhorn and the surface of the dish, try moving the feed in and out at tiny intervals of a fraction of an inch to see if the signal strength improves.

DBS satellites such as TV Sat, TDF, Thor, Tele-X, and Hispasat each use a single sense of circular polarization (either right-hand or left-hand) to transmit all of their available channels. There is no need to fine tune the polarization of the feedhorn for home receiving systems dedicated to the reception of one of these birds because the feed's polarization setting was set at the factory for maximum signal reception. Other satellites, however—such as Astra and EUTELSAT—use opposite senses of linear (horizontal/vertical) polarization to transmit a greater number of channels from a single orbital position. In this case, check to see that you can "skew" the feedhorn's polarizer by using the receiver's polarization or skew control. You should be able to skew slightly past a peak picture when receiving channels using either sense of polarization.

Fig. 6-7. Analysis of the Modified Polar Mount. (Illustration derived from original presentation by Stephen J. Birkill during the early 1980s.)



Angle A = The non-parallelism (the inclination by a fraction of a degree toward the Equator from parallel) of the Modified Polar Mount.

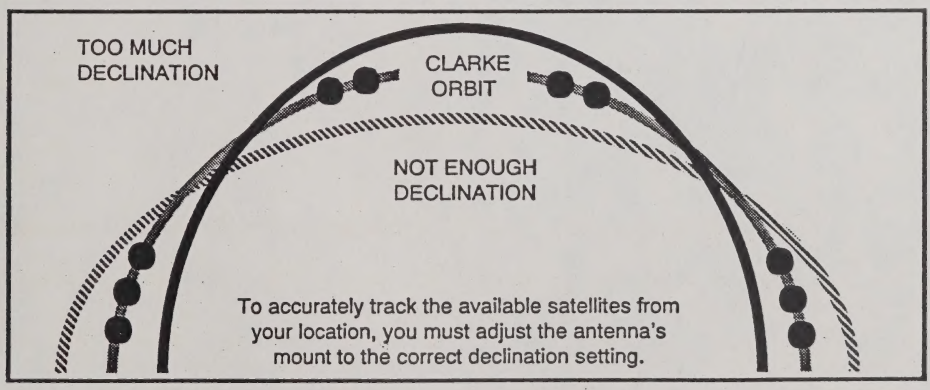
Angle B = The declination or "offset angle".

Angle ø = Adjustment from horizontal set according to site Latitude.

Fig.7-17. Declination offset angles.

N. or S LATITUDE	NEARBY CITY/REGION	POLAR AXIS ANGLE	ARC ZENITH	DECLINATION ANGLE
43	Vladivostok	43.72	49.61	5.89
41		41.71	47.38	5.67
40	Beijing, China	40.71	46.27	5.56
39		39.70	45.15	5.45
37	Seoul, Korea	37.69	42.90	5.21
35	Tokyo, Japan	35.68	40.65	4.97
33		33.67	38.38	4.71
31	Shanghai	31.64	36.11	4.47
30		30.63	34.96	4.33
29		29.62	33.82	4.20
28		28.61	32.68	4.07
25	Karatchi, PK	25.57	29.23	3.66
20	Haikou, China	20.47	23.45	2.98
15	Manila, PH	15.37	17.62	2.25
10	HCM City, VN	10.26	11.77	1.51
05	Brunei	05.13	05.89	0.76
Equator		0	0	0
05		05.13	05.89	0.76
10	Port Moresby	10.26	11.77	1.51
15		15.37	17.62	2.25
20		20.47	23.45	2.98
25		25.57	29.23	3.66
28	Brisbane, Aust.	28.61	32.68	4.07
29		29.62	33.82	4.20
30		30.63	34.96	4.33
31	Perth, Aust.	31.64	36.11	4.47
33	Sydney, Aust.	33.67	38.38	4.71
37	Auckland, NZ	37.69	42.90	5.21
40		40.71	46.27	5.56

(IN DEGREES)


TOO MUCH DECLINATION
CLARKE ORBIT
NOT ENOUGH DECLINATION
To accurately track the available satellites from your location, you must adjust the antenna's mount to the correct declination setting.

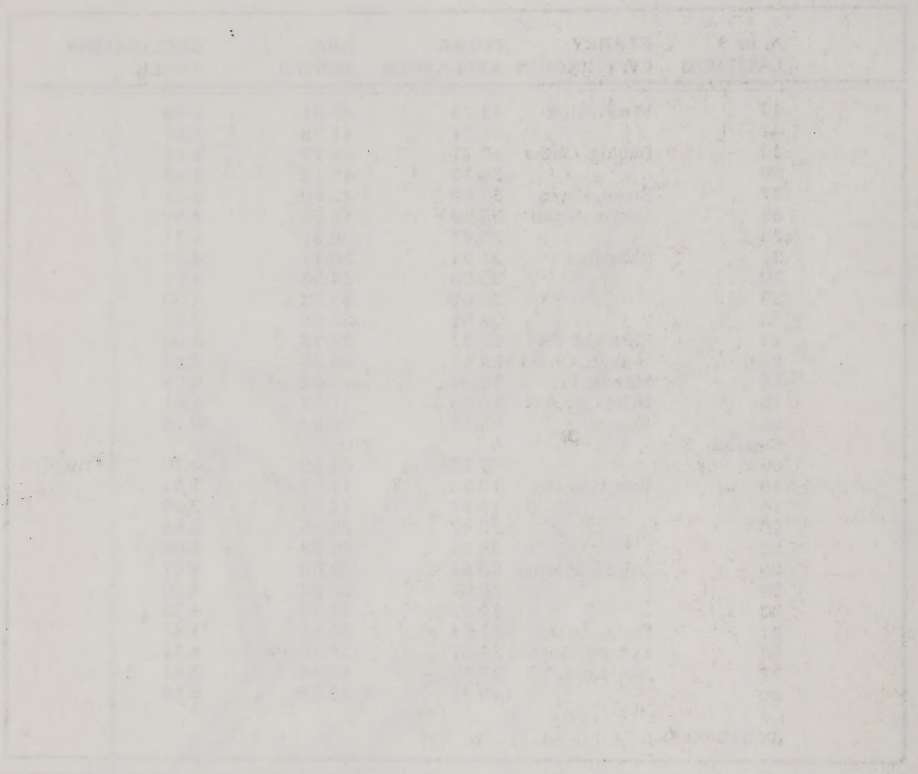
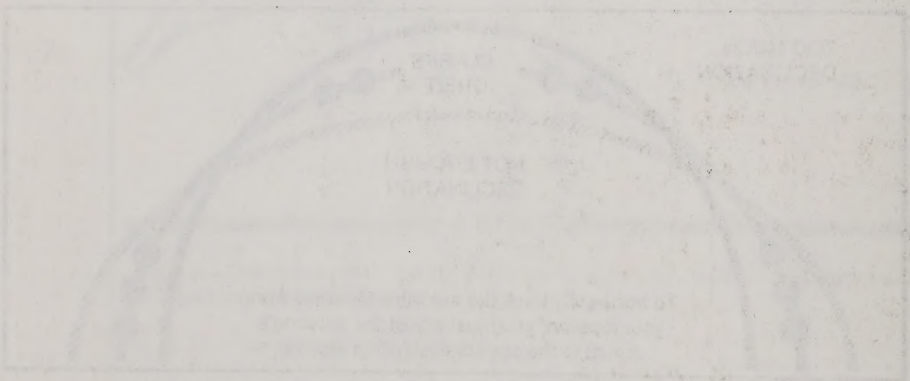



Fig.7-18. Effects of declination adjustment.